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OPTICAL RADAR.(U)

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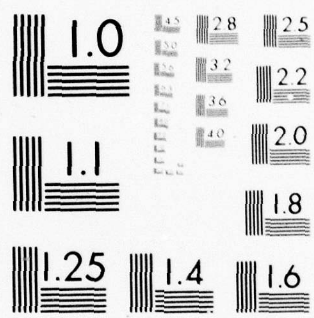
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Optical Scanning
Optical Detection
Optical Images
Target Acquisition
Target Recognition
Target Discrimination
Lasers

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This bibliography contains unclassified-unlimited citations on *Optical Radar*. These citations express the use of optical radar techniques, optical devices and techniques, laser applications, optical detection, tracking and scanning, target recognition and discrimination, target acquisition, optical surveillance and performance evaluation guides. The four computer-generated index provided are Corporate Author-Monitoring Agency, Subject, Title and Personal Author.

F O R E W O R D

This bibliography contains 214 unclassified-unlimited citations on *Optical Radar*.

These citations are studies and analyses pertaining to optical radar techniques, optical devices and techniques, laser applications, optical detection, and target recognition and discrimination.

Entries have been selected from references processed into the Defense Documentation Center data bank from January 1953 through January 1978.

This report supersedes DDC report bibliography on *Optical Radar*, AD-723 930, DDC-TAS-71-18-I, dated May 1971.

Individual entries are arranged in AD number sequence under the heading bibliographic references. Computer-generated indexes of Corporate Author-Monitoring Agency, Subject, Title and Personal Author are provided.

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AD-B001 019   15/2   20/5   17/8
STANFORD RESEARCH INST MENLO PARK CALIF ELECTRONICS AND RADIO SCIENCES DIV

Optical Techniques for the Remote Detection of Biological Aerosols. (U)

DESCRIPTIVE NOTE: Final rept. Jul 72-Dec 73,
AUG 74   105P   Oblanas,John ;Ross,David ; Simmon,Vincent ;Ludwig,F. L. ;Anbar,Michael ;

CONTRACT: DAAA15-72-C-0338
PROJ: SRI-2046
MONITOR: ED   CR-74021

UNCLASSIFIED REPORT

DESCRIPTORS: (*Biological aerosols, Detection), (*Optical radar, Biological aerosols), (*Bacterial aerosols, Detection), Remote systems, Fluorescene, Excitation, Spectra, Performance(Engineering), Sensitivity, Range(Distance), Reliability, Concentration(Composition), Viability, Reaction time, Mobile, Fluorometers, Bacillus subtilis, Escherichia coli, Pseudomonas aeruginosa, Staphylococcus aureus, Streptococcus, Polarization, Life expectancy, Diffusion, Atomization, Ruby lasers (U)
IDENTIFIERS: Mark-9 lidar system (U)

Laboratory and remote detection experiments with optical techniques demonstrated the feasibility of remote fluorescence detection of biological aerosols. Laboratory measurements of fluorescence response of five types of bacteria were best characterized by excitation spectra. A lidar field experiment verified the principle of fluorescence detection of biological aerosols under atmospheric conditions and enabled evaluation of achievable remote sensing performance. Performance calculations indicated that an optical detection of 14 cells per liter of air could be achieved at a range of 2 kilometers at sea level in midlatitude locations. (U)

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DDC REPORT BIBLIOGRAPHY   SEARCH CONTROL NO. ZOM07

AD-A051 245   4/1   17/9   17/8
FRAUNHOFER-GESELLSCHAFT GARMISCH- PARTENKIRCHEN (WEST GERMANY) INST FUER ATMOSPHAERISCHE UMWELTFORSCHUNG

Analysis of Aerosol Transport Aerosol Remote Sensing by Lidar. (U)

DESCRIPTIVE NOTE: Final technical rept. Jan-Sep 77,
SEP 77   96P   Reiter,Reinhold ;Carnuth, Walter ;Littfass,Michael ;Jaeger,Horst ;
CONTRACT: DA-ERO-75-G-077
PROJ: 1T161102B52B
TASK: 00

UNCLASSIFIED REPORT

DESCRIPTORS: *Aerosols, *Remote detectors, *Optical radar, *Atmospheric motion, Turbulence, Transport properties, Calibration, Resolution (U)
IDENTIFIERS: Lidar, AS52B, PE61102A, WU441 (U)

Final report concerns primarily techniques and instrumentation adaptation (incl calibration) and trial as these relate to analysis of aerosol transport and aerosol remote sensing by Lidar. Investigator concludes that the techniques and instruments which he has investigated operated successfully. (Author) (U)

AD-A048 979 17/5 17/9 20/5
MASSACHUSETTS INST OF TECH LEXINGTON LINCOLN LAB

System Design Study for Infrared Airborne Radar (IRAR). (U)

DESCRIPTIVE NOTE: Technical note.,
OCT 77 73P Becherer,Richard J. ;
REPT. NO. TN-1977-29
CONTRACT: F19628-78-C-0002
PROJ: 649L
MONITOR: ESD TR-77-271

UNCLASSIFIED REPORT

DESCRIPTORS: *Forward looking infrared systems, *Infrared tracking, *Optical radar, Moving target indicators, Resolution, Radar clutter, Infrared images, Local oscillators, Infrared lasers, Heterodyning, Infrared telescopes, Tracking telescopes, All weather aviation, Airborne (U)
IDENTIFIERS: Angular resolution, Maksutov-Cassegrain telescopes, PE65705F (U)

This technical note describes the design of a tactical near-all-weather infrared airborne radar (IRAR). The requirements for this radar include both (1) wide field MTI search for target detection against a cluttered terrain background and (2) narrow field high angular resolution imagery for target recognition and identification. The principal new technology issues identified and techniques proposed include a heterodyne detection antenna/receiver in an array configuration, compact Maksutov-Cassegrain telescope optics design, MTI pulse integration signal processing, and real time image processing for speckle and glint reduction. Expected weather penetration capability for this radar is assessed with the aid of a recent analysis of real weather data from a number of locations in Central Europe. (Author) (U)

AD-A047 510 6/18 20/5 17/8
ARMY ENVIRONMENTAL HYGIENE AGENCY ABERDEEN PROVING GROUND MD

Stanford Research Institute Light Detection and Ranging (LIDAR) System Mark IX Lasers
22 September 1977. (U)

DESCRIPTIVE NOTE: Nonionizing radiation protection special study,
DEC 77 9P Del Valle,Pedro F. ;Crews, Darius J. ;
REPT. NO. USAEHA-42-0331-78

UNCLASSIFIED REPORT

DESCRIPTORS: *Lasers, *Optical radar, *Optical scanning, *Radiation hazards, *Protection, *Standards, *Laser radiobiology, Health, Control, Test and evaluation (U)
IDENTIFIERS: *Lidar (U)

A special study of optical radiation hazards was performed on two light detection and ranging system lasers. Both lasers were Class IV high power lasers. The protection standard for intrabeam viewing could be exceeded out to a range of 9.9 km for the ruby laser and 210 m for the CO_2 laser. (Author) (U)

AD-A042 530 17/9 17/5 9/3
ROCKWELL INTERNATIONAL ANAHEIM CALIF

Investigation of Surface Optical Waves for Optical Signal Processing. (U)

DESCRIPTIVE NOTE: Final technical rept. 1 Jun 74-1 Jun 77,
JUN 77 136P McMullen,J. D. ;Mills,D. L. ;
REPT. NO. C77-464/501
CONTRACT: DAHC04-74-C-0024
PROJ: D0161102B11B
MONITOR: ARO 12120.9P

UNCLASSIFIED REPORT

DESCRIPTORS: *Carbon dioxide lasers, *Optical radar, *Chirp radar, *Pulsed lasers, Delay lines, Surface waves, Signal processing, Optical detection, Phase modulation, Nonlinear propagation analyses, Pulse compression, Surface roughness, Light scattering, Beryllium oxides, Dispersing, Radiation attenuation (U)
IDENTIFIERS: Polaritons, AS11B, PE61102A (U)

Propagation and temporal compression of frequency-chirped CO2 laser pulses has been investigated, wherein a dispersive optical pulse delay line is formed using dispersive surface and bulk phonon-polariton propagation modes in solids. Criteria are developed for the compression of optical pulses, and these criteria are compared to the relevant group-dispersive properties of the propagation modes to determine their suitabilities for performing laser pulse compression. Absorption in the infrared-active medium has been shown to limit the magnitude of group dispersion available, in addition to limiting the attenuation length of each propagation mode. For the materials considered, absorption limits the application of this approach to CO2 laser pulses having initial widths of 10 psec or smaller with initial chirp bandwidths in the THz range, if attenuation by absorption is to be limited to 50 dB. Both the narrow pulse width and large chirp bandwidth requirements preclude experimental demonstration with present CO2 laser technology. (U)

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AD-A042 349 17/8 20/5 20/14
ARMY MISSILE RESEARCH AND DEVELOPMENT COMMAND REDSTONE ARSENAL ALA PHYSICAL SCIENCES DIRECTORATE

Surface Detail and Backscatter from Coherently Illuminated Targets Rotating about the Axis of Symmetry. (U)

DESCRIPTIVE NOTE: Technical rept.,
FEB 77 41P Smith,J. Lynn ;
REPT. NO. DRDMI-TR-77-3
PROJ: 8X363304D215

UNCLASSIFIED REPORT

DESCRIPTORS: *Lasers, *Backscattering, *Optical radar, *Coherent optical radiation, Far field, Surface roughness, Monostatic radar, Radar targets, Rotation (U)
IDENTIFIERS: Speckle, AS215, PE63304A (U)

A theoretical analysis of the ratio of rms backscattered intensity fluctuation to average intensity for a coherently illuminated target rotating about an axis of symmetry is presented in this report. The ratio delta I sub rms/<I> depends on the rms random phase fluctuation and the number of decorrelation area cells on the exposed target surface. For the case where the random phase fluctuations are due to surface roughness, the ratio depends on the equivalent surface detail parameters: (1) rms height fluctuation and (2) the product of average roughness slope and the square root of the exposed target surface. The ratio delta I sub rms/<I> is also dependent on the illumination wavelength, and the two surface detail parameters can be uniquely determined if the wavelength dependence of the ratio is measured. The analysis presented is especially relevant to laser radar applications. (Author) (U)

AD-A041 085 4/1 16/3 22/3 17/8
ARMY ELECTRONICS COMMAND FORT MONMOUTH N J

Lidar Detection of Subvisible Reentry Vehicle Erosive Atmospheric Material. (U)

DESCRIPTIVE NOTE: Research and development technical rept.,
MAR 77 32P Rubio,Roberto ;
REPT. NO. ECOM-5813
PROJ: 1L161102053A

UNCLASSIFIED REPORT

DESCRIPTORS: *Atmospheric sounding, *Optical radar, *Optical detection, *Atmosphere entry, *Ablation, Atmospheric density, Atmospheres, Particulates, Aerosols, Erosion, Nose cones, Reentry vehicles, Clouds, Water, Ice (U)
IDENTIFIERS: Atmospheric layers, Subvisible, Lidar, Laser radar, Athena, PE61102A, AS53A (U)

This report describes a lidar technique employed to detect conventionally undiscernible atmospheric particulate concentrations which cause unexpected nose-cone erosions of reentry missiles. It also describes the experiment, data, and data analysis results obtained during several Athena-H reentry missions conducted at White Sands Missile Range, New Mexico. Lidar data recorded on the Athena-H reentry nights of 26 April and 24 August 1973 provided information on subvisible tenuous layers located at heights of 9.3 km and 14.3 km, respectively. Analysis of the lidar data, concurrently recorded radiosonde meteorological data, and a clear day aerosol model yielded an average volume backscattering coefficient of 0.000043/m for the 9.3 km layer which was 310 m thick and 0.000032/m for the 14.3 km layer which was 500 m in depth. Calculations based on previous in-situ measurements of particulate sizes and elemental composition yielded an average concentration of 3.7 x 10 to the 5th power liquid droplets/cu/m or 26,000 ice crystals/cu/m for the 26 April cloud striation and an average concentration of 20,000 ice particles/cu/m or 2.2 x 10 to the 8th power arid particles/cu/m for the 24 August layer. The lidar data clearly distinguished between a truly clear atmospheric path, (U)

AD-A041 082 20/5 17/8
SPACE AND MISSILE TEST CENTER PATRICK AFB FLA DETACHMENT 1

Laser Ranging on Test 7688. (U)

DESCRIPTIVE NOTE: Technical memo.,
MAR 77 11P Kennedy,John M. ;
REPT. NO. SAMTEC/Det 1-TR-77-03

UNCLASSIFIED REPORT

DESCRIPTORS: *Lasers, *Optical tracking, *Range finding, *Guided missile launchers, Guided missile trajectories, Hit probabilities, Retroreflectors, Metric system, Paints, Optical radar (U)
IDENTIFIERS: Trident missiles, Reflective paints (U)

This report presents the results of a test of the Laser Ranging system against the launch of a Trident missile coated with a band of reflective paint. Four consecutive laser hits at one second intervals were recorded and compared favorably, metrically, to the Best Estimate of Trajectory for this launch. (Author) (U)

AD-A039 734 17/8 20/5 20/6
HUGHES RESEARCH LABS MALIBU CALIF

Multidither Adaptive Algorithms. (U)

DESCRIPTIVE NOTE: Interim technical rept. 1 Jul 76-30 Jan 77,
MAR 77 86P Lind,R. C. ;Price,K. D. ;Brown,K. M. ;Calderone,T. ;Pearson,J. E. ;

CONTRACT: F30602-76-C-0022
MONITOR: RADC TR-77-119

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: See also AD-035 150.

DESCRIPTORS: *Optical radar, *Lasers, *Mirrors, *Beryllium, *Thermal blooming, Coherent optical radiation, Laser beams, Adaptive systems, Algorithms, Computerized simulation, Atmospheres, Turbulence, Self organizing systems (U)
IDENTIFIERS: *Deformable mirrors, Coat(Coherent optical adaptive techniques), Coherent optical adaptive tecnniques (U)

A 37-element beryllium deformable mirror has been built, characterized, and incorporated into a Coherent Optical Adaptive Technology (COAT) system. Individual actuator deformation sensitivities of 0.2 micrometer/150 V have been measured. Mirror resonance data has been obtained indicating usable frequency ranges up to 30 to 40 kHz. Strehl ratios approaching 80% have been measured for system defocus with COAT-off to COAT-on peak irradiance of 10. (Author) (U)

AD-A038 976 17/8 20/5 17/5
RADIATION RESEARCH ASSOCIATES INC FORT WORTH TEX

Multiple Scattering Effects upon Measurements with the AFGL LSRVMS Lidar System. (U)

DESCRIPTIVE NOTE: Final rept. 1 Dec 75-15 Dec 76,
JAN 77 87P Blaettner,Wolfram G. M. ;
REPT. NO. RRA-T7609
CONTRACT: F19628-76-C-0130
PROJ: 6670
TASK: 04
MONITOR: AFGL TR-77-0003

UNCLASSIFIED REPORT

DESCRIPTORS: *Optical radar, *Infrared lasers, Backscattering, Monte Carlo method, Scattering, Fog, Visibility, Measurement, Photons, Models, Transmissometers, Energy, Range(Distance), Atmospheres (U)
IDENTIFIERS: *Lidar, PE62101F, WUAFGL66700403 (U)

This report describes Monte Carlo calculations that were made to determine the effects of multiple scattering on the meteorological ranges (visibilities) obtained through a single-scattering analysis of the measured time-dependent signals to be obtained from the AFGL LSRVMS lidar system. Multiple scattering was found to affect the accuracy of visibility measurements in both radiation and advection fogs for low visibilities such that the visibility obtained from the experiment is higher than the true visibility. The deviation of the computed visibility from the true visibility was small (1 to 4%) for the radiation fog model at all visibilities studied, but for the advection fog the deviation of the computed visibility from the true visibility varied from 15% to 2% as the true visibility varied from 50 meters to 1000 meters. (Author) (U)

AD-A038 725 17/8 20/5 20/6
NATIONAL BUREAU OF STANDARDS WASHINGTON D C INST FOR BASIC STANDARDS

Proposed Standards for Ladar Signatures. (U)

DESCRIPTIVE NOTE: Final rept.,
APR 77 39P Danielson,B. L. ;
REPT. NO. NBSIR-77-856

UNCLASSIFIED REPORT

DESCRIPTORS: *Optical radar, *Lasers, *Optical signatures, Standardization, Calibration, Cross sections, Diffusers, Polarization, Radar cross sections, Doppler effect, Bibliographies (U)
IDENTIFIERS: Laser signatures, Laser radar, Laser targets (U)

The laser radar (LR) signatures program sponsored by the Ballistic Missile Defense Advanced Technology Center is directed towards employing LR target scattering for the identification and discrimination of threatening objects. The scattered target radiation is usually expressed in terms of various types of laser radar cross sections (LRCS). Unfortunately, in the past there has not been universal agreement on the precise definitions of the LRCS's of interest, nor has there been a common traceable method for calibrating the diverse systems used in measuring experimental values of LRC's. For example, cross section definitions based on radar use can differ by a factor of 4 from definitions based on the optical use of diffuse plates. Polarization is another factor that is not consistently taken into account. This report represents an effort by the National Bureau of Standards (NBS) to encourage the adoption of a common basis for LRCS measurements. (U)

AD-A037 774 17/8 20/5 20/6
RIVERSIDE RESEARCH INST NEW YORK

Photocounting Image Tracking of Fluctuating Targets. (U)

DESCRIPTIVE NOTE: Technical rept.,
FEB 77 128P Elbaum,Marek ;
REPT. NO. RRI-T-1/364-3-65
CONTRACT: DAAK40-76-C-0500, ARPA Order-2281

UNCLASSIFIED REPORT

DESCRIPTORS: *Optical radar, *Optical tracking, *Laser tracking, Images, Targets, Position finding (U)
IDENTIFIERS: *Laser radar, Laser speckle, Photocounting, Noncoherent detection (U)

A theory of estimation of angular position and other attributes of optically rough and smooth targets with a monopulse laser radar is developed. It applies to systems deriving information about the target position by sensing its image with an array of noncoherent detectors. The theory develops quantitative formulations of the fundamental limitations imposed upon measurement accuracy by the shot noise arising from both the target return and the background radiation, by the detector dark current, and by the random fluctuations of the target cross section. (Author) (U)

AD-A036 503 17/8 20/6 4/1
OREGON GRADUATE CENTER BEAVERTON

Propagation of Multiwavelength Laser Radiation through Atmospheric Turbulence. (U)

DESCRIPTIVE NOTE: Final rept. 1 Feb-30 Nov 76,
JAN 77 72P Kerr,J. Richard ;Elliott, Richard A. ;Fossey,Michael E. ;Holmes,J. Fred ;Lee,Myung H. ;
CONTRACT: F30602-74-C-0082, ARPA Order-1279
MONITOR: RADC TR-77-18

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: See also report dated Apr 76, AD-A024 863.

DESCRIPTORS: *Laser beams, *Laser tracking, *Optical radar, *Adaptive systems, Target signatures, Atmospheric motion, Turbulence, Analysis of variance, Covariance, Scintillation, Glint, Phase modulation, Amplitude modulation, Coherent radiation, Computer aided diagnosis, Mathematical prediction, Wave propagation (U)
IDENTIFIERS: Atmospheric transmissivity, Atmospheric attenuation, Adaptive optics, Coherent Optical Adaptive Techniques, Speckle patterns (U)

A complete theory is presented for the statistical effects of atmospheric turbulence on coherent radiation reflected from a diffuse target. This study, which is motivated by the need to understand speckle and scintillation effects on the operation of coherent adaptive optical transmitter (COAT) systems, constitutes a significant advance in the field of turbulence scattering phenomena. Both phase and amplitude perturbations are taken into account, and the analysis includes multiple scattering (saturation) conditions and finite receiver apertures. The development is free from certain restrictive assumptions employed in previous work, and yields results for the variance and covariance of irradiance which lead to clear physical insight. It is found that the covariance comprises two additive terms which represent respectively: (1) the incoherent scattering mechanism which is independent of source spectral width, and (2) the coherent mechanism related to 'speckles'. (U)

AD-A036 302 17/8 20/6
GENERAL RESEARCH CORP MCLEAN VA WASHINGTON OPERATIONS

COAT: Modal-Zonal Comparison. (U)

DESCRIPTIVE NOTE: Final rept.,
AUG 76 111P Radley,J. ;Nomiyama,N. ; Wilson,J. ;Gurski,G. ;
CONTRACT: N60921-76-C-0122

UNCLASSIFIED REPORT

DESCRIPTORS: *Optical radar, *Laser tracking, *Phase modulation, Adaptive systems, Interference, Coherent radiation, Self organizing systems, Target signatures, Phased arrays, Computerized simulation, Signal processing, Space surveillance systems (U)
IDENTIFIERS: Coherent Optical Adaptive Techniques, Dither, *Adaptive optics, Optical modulators, Atmospheric transmissivity (U)

The objective of this program was to assess the effects of target-COAT interactions comparing modal multidither with zonal multidither and phase-conjugate systems. A potential problem exists when target modulation overlaps the COAT sensing bandwith, causing erroneous control signals to be generated. Differences in modal and zonal transmitters are of potential importance in closed-loop performance with distributed targets. The performance of a modal multidither Coherent Adaptive Optics Techniques (COAT) System is investigated via simulations with distributed dynamic targets. Target influence on performance is shown to be similar to that of zonal systems in that target effects can degrade and prevent convergence. However, additional design alternatives are shown to be possible with a modal system that cannot be achieved with a zonal system. (U)

AD-A035 880 17/8 20/5 20/6
GENERAL RESEARCH CORP MCLEAN VA WASHINGTON OPERATIONS

Sensor Modulation Effects upon Laser Signatures. (U)

DESCRIPTIVE NOTE: Final technical rept.,
DEC 76 177P Gilbert,J. L. ;Kramer,P. J. ;Peters,W. N. ;
REPT. NO. 905-01-CR
CONTRACT: F30602-75-C-0292
PROJ: 6527
TASK: 01
MONITOR: RADC TR-76-391

UNCLASSIFIED REPORT

DESCRIPTORS: *Target signatures, *Laser tracking, *Optical radar, Optics, Propagation, Coherent optical radiation, Doppler effect, Range finding, Shot noise (U)
IDENTIFIERS: Speckle, WURADC65270131, PE62702F (U)

This study is an analysis of coherent sensor system observable effects which tend to obscure target properties of interest. The main effects studied are finite system resolution, speckle, shot noise, and atmospheric propagation. In addition to these effects, several scenarios were considered to provide realistic assessments of their effects on the performance of laser radar systems. Also included is an investigation of the feasibility of performing range-Doppler imaging using different lasers in the measurement of range and Doppler. The analysis was made to determine the existence and extent of any fundamental problem areas which would prohibit or seriously limit the use of this technique. (Author) (U)

AD-A035 480 20/5 6/18
RAYTHEON CO SUDBURY MASS EQUIPMENT DIV

Slant Range Visibility Measuring LIDAR. (U)

DESCRIPTIVE NOTE: Final rept. Jul 74-Sep 76,
SEP 76 84P McManus,Ralph G. ;Chabot, Arthur A. ;Young,Robert M. ;Novick,Leonard R. ;
REPT. NO. ER76-4355
CONTRACT: F19628-75-C-0021
PROJ: 6670
TASK: 04
MONITOR: AFGL TR-76-0262

UNCLASSIFIED REPORT

DESCRIPTORS: *Ultraviolet lasers, *Optical radar, *Laser damage, *Laser hazards, Slant range, Visibility, Fog, Eye, Safety, Photomultiplier tubes, Pilots, Signal to noise ratio, High voltage, Power supplies (U)
IDENTIFIERS: WUAFGL66700403, PE62101F (U)

This design report presents the results of efforts to establish equipment parameters required for a single-ended transmissometer system to measure the visibility along a slant range such as that corresponding to the line of sight of a pilot in an aircraft approaching an airport runway. (Author) (U)

AD-A035 150 17/8 20/6 4/1
HUGHES RESEARCH LABS MALIBU CALIF

Multidither Adaptive Algorithms. (U)

DESCRIPTIVE NOTE: Interim technical rept. 1 Nov 75-30 Jun 76,
NOV 76 63P Pearson,James E. ;Brown,K. M. ;Minden,M. L. ;Price,K. D. ;Yeh,C. ;
CONTRACT: F30602-75-C-0022, ARPA Order-1279
MONITOR: RADC TR-76-364

UNCLASSIFIED REPORT

DESCRIPTORS: *Optical radar, *Laser beams, *Mirrors, *Beryllium, *Thermal blooming, Adaptive systems, Algorithms, Computerized simulation, Atmospheres, Turbulence, Self organizing systems (U)
IDENTIFIERS: Coherent optical adaptive techniques, *Atmospheric transmissivity, Atmospheric attenuation, Adaptive optics, Deformable mirrors, Dither effect (U)

The use of Zernike-polynomial modal-control coherent optical adaptive techniques (COAT) in a multidither adaptive optical system has been studied analytically. The studies have defined those modes which will be implemented into an experimental COAT system for studying thermal blooming compensation. No apparent advantage in degree of phase correction has been established for modal versus zonal multidither control. A 37-element, all-beryllium, deformable mirror has been constructed. Preliminary tests show a surface deformation sensitivity of 0.28 micrometers/150 V and a usable frequency response to 30 KHz. Corrected irradiance-tailoring results reaffirm an earlier conclusion that thermal blooming is best minimized by making the transmitter aperture as large as possible and the irradiance distribution as uniform as possible. (U)

AD-A034 812 17/5 17/9 17/8
MASSACHUSETTS INST OF TECH LEXINGTON LINCOLN LAB

Wideband 10.6 micrometers Backscatter Range
Interim Report. (U)

DESCRIPTIVE NOTE: Project rept.,
NOV 76 71P Tomasetta,Louis R. ;Carter, Gary M. ;Edelstein,Marcus S. ;
REPT. NO. LRP-4
CONTRACT: F19628-76-C-0002, ARPA Order-600
MONITOR: ESD TR-76-321

UNCLASSIFIED REPORT

DESCRIPTORS: *Optical radar, *Chirp radar, *Infrared detectors, *Doppler radar, Carbon dioxide lasers, Far infrared radiation, Infrared images, Local oscillators, Resolution, Backscattering, Range finding, Infrared scanning, Signal to noise ratio, Infrared pulses, Infrared lasers (U)

This report summarizes the principles, hardware and performance of a high resolution 10.6 micrometer optical backscatter range. Included is a description of the backscatter range, optical setup and processing capabilities. Results include demonstration of the high resolution range and doppler capabilities of the wideband waveform as well as the first high resolution 10.6 micrometer range-resolved angel-angle scanned and range-doppler images. (U)

AD-A032 472 15/2 17/8 7/4
STANFORD RESEARCH INST MENLO PARK CALIF

Optical Bases for Remote Biological Aerosol Detection. (U)

DESCRIPTIVE NOTE: Quarterly progress rept. no. 2, 17 Mar-2 Jul 76,
NOV 76 18P Grant,William B. ;
CONTRACT: DAAA15-76-C-0042
PROJ: DA-1-W-762711-AD-34, SRI-4805
TASK: 1-W-762711-AD-3402
MONITOR: ED CR-76103

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: See also report dated 23 Mar 76, AD-A028 289.

DESCRIPTORS: *Biological aerosols, *Remote detectors, *Optical radar, *Bacterial aerosols, Chemical analysis, Fluorescence, Fluorometers, Tryptophan, Bacillus subtilis, Monitors, Sensitivity, Calibration, Excitation (U)
IDENTIFIERS: Fluorescein (U)

Measurements and calculations are being made to determine whether lidar techniques based on fluorescence and scatter can remotely detect and identify biological aerosols. The spectrofluorimeter has been calibrated. A forward-scatter instrument has been assembled to monitor aerosol flow rate. The facilities for generating aerosols have been assembled, tested, and calibrated. Aerosol concentrations up to 80 mg/cu m have been generated from 1% solutions of ammonium fluorescein. The mass median diameters of the dried particles are in the range of 2 to 5 micrometer. Preliminary measurements of the excitation and fluorescence spectra of aerosols of ammonium fluorescein and tryptophan have been made. A 20-m cell for the measurement of extinction by aerosols has been purchased. (U)

AD-A031 555 19/1 20/5
HARRY DIAMOND LABS ADELPHI MD

Electronic Design of a Slant-Range Optical Proximity Sensor. (U)

DESCRIPTIVE NOTE: Technical memo.,
SEP 76 28P Vanderwall,Jonathan ;
REPT. NO. HDL-TM-76-16

UNCLASSIFIED REPORT

DESCRIPTORS: *Optical fuzes, *Proximity fuzes, *Injection lasers, *Laser modulators, *Optical radar, Slant range, Electrooptics, Light pulses, Pulsed lasers (U)

This paper describes the electronic design of a slant-range optical proximity sensor using a pulse-modulated injection laser for the transmitter and a direct-detection receiver for the collection of target returns, much after the manner of a conventional pulse-radar. Of particular interest is the development of laser modulator circuitry to produce 50-A pulses up to 200 ns wide at repetition rates up to 2 kHz. (Author) (U)

AD-A031 201 4/1 14/2
AMERICAN OPTICAL CORP SOUTHBRIDGE MASS

Erbium Lidar Cloud Base measuring System. (U)

DESCRIPTIVE NOTE: Final rept. Jan 74-July 76,
AUG 76 37P Segre,Joseph ;
REPT. NO. AO-623-F
CONTRACT: F19628-74-C-0150
PROJ: AF-6670
TASK: 667004
MONITOR: AFGL TR-76-0177

UNCLASSIFIED REPORT

DESCRIPTORS: *Optical radar, *Cloud height indicators, Infrared lasers, Clouds, Height finding, Eye, Hazards, Sky brightness, Reflectance, Signal processing, Photodiodes, Germanium, Instrumentation, Erbium, Rain, Snow, Fog, Detectors (U)
IDENTIFIERS: Erbium doped glass lasers, Lidar ceilometers, Eye safety (U)

Results of development and testing of an Erbium Doped Glass Laser Ceilometer are presented and discussed. Various cloud returns, corresponding to differing weather conditions are shown. The rain, snow, or fog detector is discussed. (Author) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOM07

AD-A029 885 17/9 17/5 17/8
ENVIRONMENTAL RESEARCH INST OF MICHIGAN ANN ARBOR

Proceedings of the International Symposium on Remote Sensing of Environment (10th), 6 - 10 October, 1975. Volume I. (U)

OCT 75 721P
CONTRACT: AF-AFOSR-2897-75
PROJ: AF-9751
TASK: 975105
MONITOR: AFOSR 76-0934-Vol-1

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: Prepared in cooperation with Michigan Univ., Extension Service. See also Volume 2, AD-A029 886.

DESCRIPTORS: *Remote detectors, *Radar, *Infrared detectors, *Optical radar, Symposia, Infrared signatures, Space surveillance systems, Meteorological satellites, Global (U)
IDENTIFIERS: Lidar, LANDSAT Satellites (U)

These Proceedings contain papers presented at the Tenth International Symposium on Remote Sensing of Environment, held October 6th through 10th, 1975, on the campus of The University of Michigan, Ann Arbor, Michigan. This symposium, conducted by the Environmental Research Institute of Michigan, is part of a continuing program investigating current activities in the field of remote sensing. The meeting is primarily intended to stimulate an exchange of information on numerous aspects of the field, through the presentation of reports on work planned, in progress, or completed. Presentations contained herein include those concerned with the utilization of this technology in various national and international programs as well as in numerous applications for monitoring and managing the earth's resources and man's global environment. Ground-based, airborne and spaceborne sensor systems and both manual and machine-assisted data analysis and interpretation are included. (Author) (U)

AD-A029 411 17/8 13/10 17/5
NAVAL ELECTRONICS LAB CENTER SAN DIEGO CALIF

Underwater Range Measurements. Electro-optical Techniques as an Aid in Positive Coupling of the Deep Submergence Rescue Vehicle (DSRV) with a Disabled Submarine. (U)

DESCRIPTIVE NOTE: Technical rept. Nov 75-Apr 76.
JUL 76 45P Whitman,W. H. ;
REPT. NO. NELC/TR-1992
PROJ: S4636, NELC-F234
TASK: 19171

UNCLASSIFIED REPORT

DESCRIPTORS: *Distance measuring equipment, *Optical radar, *Underwater equipment, *Range finding, Deep submergence rescue vehicles, Electrooptics, Light emitting diodes, Photodiodes, Submarine escape, Sea water, Silicon, Hatches, Parallel orientation, Interfaces (U)

Pilots of a Deep Submergence Rescue Vehicle (DSRV) have experienced difficulty attaining a trim attitude for coupling with the hatch of a simulated disabled submarine. To provide navigation information during this crucial maneuver, electro-optical technology was investigated to measure the separation distance of the two vehicles. The effectiveness of a light-emitting-diode (LED) and a photodiode ranging unit in water was analyzed and demonstrated. Analysis indicated an optimum source wavelength of 690 nm for the device as conceived rather than a blue-green source. LEDs are available at this wavelength with sufficient radiant power to measure a range of less than 10 feet in water. The feasibility of underwater ranging was demonstrated. The ranging device used for the feasibility tests was originally designed for other purposes. With the recommended changes, the electro-optical underwater ranging system will provide an accurate measurement of the coplanarity between the DSRV and a disabled submarine. (Author) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOMO7

AD-A029 394 20/6 20/10 17/8 17/2
PENNSYLVANIA STATE UNIV UNIVERSITY PARK

An Experiment and Theoretical Investigation of Detection Statistics for Optical Frequency Radar Systems and Communication Systems. (U)

DESCRIPTIVE NOTE: Final rept. 1 Jul 73-30 Jun 76,
JUL 73 8P Lachs,Gerard ;
CONTRACT: DAHC04-73-C-0036
MONITOR: ARO 11758.4-EL

UNCLASSIFIED REPORT

DESCRIPTORS: *Laser communications, *Optical radar, *Quantum statistics, Optics, Atmospheric motion, Turbulence, Absorption, Photons, Photodetectors, Photodiodes (U)
IDENTIFIERS: Photocount detection systems (U)

There has been considerable interest recently in radar and communication systems which operate in the submillimeter, infra-red and optical regions of the spectrum. Each of these spectral regions has its own special problems, but common to all of these frequency ranges is that the detectors are quantum mechanical in nature. They involve the absorption of photons with corresponding changes in the state of an electron in the detector. There has also been interest in the detection statistics for multiple element optical frequency detectors such as quadrant detectors. The problems which have been investigated are the determination of the detection statistics for these radar and communication systems, and the joint detection statistics for multiple element detectors. (Author) (U)

AD-A028 800   17/5   17/8   22/3
GENERAL RESEARCH CORP MCLEAN VA WASHINGTON OPERATIONS

Laser Quadrant Tracker Simulation. (U)

DESCRIPTIVE NOTE: Final technical rept.,
JUL 76   106P   Peters,William N. ;Nomiyama, Neal T. ;
CONTRACT: F30602-75-C-0209
PROJ: AF-6527
TASK: 652701
MONITOR: RADC TR-76-204

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: See also report dated May 75, AD-A011 917.

DESCRIPTORS: *Optical radar, *Space surveillance systems, *Infrared detection, Infrared signatures, Target signatures, Signal processing, Optical detectors, Optical tracking, Doppler radar, Identification systems, Space objects, Computer applications, Carbon dioxide lasers, Heterodyning, Electrooptics, Computerized simulation, Shape (U)
IDENTIFIERS: Space Object Laser Analysis, Laser Signature Analysis Program (U)

The performance of a quadrant detector located in the focal plane of an optical system viewing a laser-illuminated rotating target is evaluated. The output signal is characterized by a computer program that synthesizes the return from complex target geometries and radiance distributions, the viewing optics, detector geometry, and post-detection processing electronics. The computer program was exercised to determine the performance of both trackers and signature analyzers for a series of system parameter values and targets of both simple and complex shape. The computer simulations indicate that open-loop pointing errors with deviations sufficient to limit the performance of a number of electro-optic systems can occur. (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY   SEARCH CONTROL NO. ZOM07

AD-A028 586   20/6   17/5   17/8
FRANK J SEILER RESEARCH LAB UNITED STATES AIR FORCE ACADEMY COLO

Wavefront Estimation for Adaptive Optics. (U)

DESCRIPTIVE NOTE: Interim rept. no. 1, Jul 74-Sep 75,
JUL 76   60P   Asher,Robert B. ;
REPT. NO. SRL-TR-76-0010
PROJ: AF-2304

UNCLASSIFIED REPORT

DESCRIPTORS: *Infrared tracking, *Optical tracking, Self organizing systems, Image processing, Laser beams, Wavefronts, Cassegrain telescopes, Mirrors, Focusing, Phase distortion, Target acquisition, Kalman filtering, Optical radar, Infrared detectors, Gas dynamic lasers, Apertures, Mathematical models, Markov processes, Corrections, Diffraction (U)
IDENTIFIERS: *Atmospheric transmissivity, Atmospheric attenuation, *Adaptive optics (U)

The first step in obtaining maximum irradiance on an object or for image compensation is that of wavefront diagnostics. This report considers the use of estimation theory techniques in order to diagnose the required wavefront changes for wavefront control. The control elements can be the adjustment of the focal length of a Cassegrain telescope by changing the distance between the primary and secondary mirrors, the control of a tilt mirror, and the control of a deformable mirror. This paper considers the use of an extended Kalman filter in order to obtain estimates of the diffraction focus position and the target range from a measurement of the reflected irradiance. The measurement is obtained by a detector with a wide field of view located near the location of the Cassegrain telescope. As the detector gain of an irradiance measurement is a function of certain target characteristics and as these characteristics may only be nominally known, a scale factor error in the detector gain is introduced and estimated. The laser system considered transmits a focused, truncated Gaussian beam at 10.6 micrometer wavelength. However the filter can be used for other wavelengths. (U)

AD-A028 298   20/6   17/8
PERKIN-ELMER CORP NORWALK CONN ELECTRO-OPTICAL DIV

Modal Wavefront Control System (MOWACS). (U)

DESCRIPTIVE NOTE: Final rept. on Phase 2, Aug 75-Jul 76,
JUL 76   90P   Neufeld,C. ;
REPT. NO. PE-13039
CONTRACT: N60921-75-C-0148

UNCLASSIFIED REPORT

DESCRIPTORS: *Optical radar, *Mirrors, *Laser beams, *Thermal blooming, Turbulence, Atmospheric motion, Corrections, Vibration, Self organizing systems, Light transmission, Computerized simulation (U)
IDENTIFIERS: *Atmospheric transmissivity, Coherent Optical Adaptive Techniques, Atmospheric attenuation, Adaptive optics, Modal wavefront Control System (U)

MOWACS (Modal Wavefront Control System) is a form of Coherent Optical Adaptive Techniques (COAT) used to obtain information required to correct turbulence and thermal blooming aberrations characteristic of high energy lasers in the atmosphere. The feasibility of replacing complex multi-segment mirror COAT systems with continuously deformable mirrors was established in Phase I. In Phase II the system was upgraded to include a 100 Hz bandwidth closed loop system and to allow the introduction of more sophisticated aberrations. (U)

AD-A028 289   15/2   17/8   7/4
STANFORD RESEARCH INST MENLO PARK CALIF

Optical Bases for Remote Biological Aerosol Detection. (U)

DESCRIPTIVE NOTE: Quarterly progress rept. no. 1, Dec 75-Mar 76,
MAR 76   10P   Grant,William B. ;
CONTRACT: DAAA15-76-C-0042
PROJ: DA-1-W-762711-AD-34, SRI-4805
TASK: 1-W-762711-AD-3402
MONITOR: EC   CR-76071

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: See also report dated Aug 74, AD-B001 019.

DESCRIPTORS: *Biological aerosols, *Remote detectors, *Optical radar, *Bacterial aerosols, Chemical analysis, Fluorescence, Bacillus subtilis, Fluorometers, Tryptophan, Excitation, Sensitivity (U)
IDENTIFIERS: Atomic absorption spectrophotometry (U)

Measurements and calculations to determine whether lidar techniques based on fluorescence can remotely detect and identify biological aerosols were made. B. subtilis, in isotonic saline, was tested by absorption measurements. Extinction (scattering plus absorption) was measured. At the absorption peak near 265 nm, optical densities for scatter and absorption were each nearly 0.5 for 10 to the 8th power organisms/ml. Extinction as a function of wavelength, using Baird Atomic SF-1 light source will be investigated. Relatively dilute samples (for B. subtilis 0.000005 organism/ml) should be used. Plans for calibration of the Baird-Atomic Fluorispec SF-1 have been modified. The laboratory van is nearly serviceable. (U)

AD-A027 209 17/5 22/4
MASSACHUSETTS INST OF TECH LEXINGTON LINCOLN LAB

10.6 MICROMETER Coherent Monopulse Tracking
Interim Results. (U)

DESCRIPTIVE NOTE: Technical note,
MAY 76 48P Teoste,Rein ;Scouler,William
J. ;
REPT. NO. TN-1976-19
CONTRACT: F19628-76-C-0002, ARPA Order-600
MONITOR: ESD TR-76-107

UNCLASSIFIED REPORT

DESCRIPTORS: *Optical radar, *Infrared tracking, *Satellite tracking systems, Monopulse radar, Coherent radar, Geodetic satellites (U)
IDENTIFIERS: GOES-3 satellite, Atmospheric attenuation (U)

The report describes the present status and recent results of 10.6 micrometer monopulse radar tracking experiments. Included is a description of the radar system and results of short range (<20 km) and long range (>150 km) tracking experiments which show that useful monopulse processing of IR radar returns can be accomplished. The short range experiments involved a stationary test tower and a moving cooperative aircraft. The long range experiment demonstrated, for the first time, 10.6 micrometer coherent monopulse tracking of a satellite. (U)

AD-A026 258 17/8 20/6
HUGHES RESEARCH LABS MALIBU CALIF

COAT/Target-Signature Interactions. (U)

DESCRIPTIVE NOTE: Interim rept. 1 Aug-31 Oct 75,
APR 76 74P Pedinoff,M. E. ;Kokorowski, S. A. ;Pearson,J. E. ;
CONTRACT: F30602-76-C-0021, ARPA Order-1279
MONITOR: RADC TR-76-64

UNCLASSIFIED REPORT

DESCRIPTORS: *Optical radar, *Phased arrays, Lasers, Target signatures, Backscattering, Amplitude modulation, Doppler effect, Acoustooptics, Computerized simulation, Fast Fourier transforms (U)
IDENTIFIERS: *Speckle patterns, Coherent Optical Adaptive Techniques, Glint, Optical modulators, Atmospheric transmissivity, Atmospheric attenuation, Adaptive optics, Helium neon lasers (U)

Target speckle modulation effects have been investigated experimentally using a number of scaled realistic targets with different shapes and surface textures, and analytically using theoretical target signature models in a computer simulation model of a multidither COAT system. The experimental results have shown that maximum contrast ratios of 0.79 can occasionally be obtained, but that the average is much lower. Significant receiver aperture integration effects cause reduction of the contrast ratio. Temporal frequency spectra obtained by rotation of the targets agree with spatial frequency data obtained by fast Fourier transform processing of the target signature data. Preliminary computer simulation results using high contrast ratio speckle data from GRC show degraded COAT system performance. A preliminary adjustment of the COAT simulation model has led to reduced susceptibility to high contrast speckle modulation. In addition, theoretical arguments, corroborated by the experimental results, indicate that such high contrast ratios are not realistic at visible wavelengths. (U)

AD-A025 669 20/6 17/8
ROCKWELL INTERNATIONAL ANAHEIM CALIF ELECTRONICS GROUP

Coherent Optical Adaptive Techniques (COAT). (U)

DESCRIPTIVE NOTE: Quarterly technical rept. 16 Jul-16 Oct 72,
OCT 72 44P Hayes,C. L. ;
REPT. NO. C72-731.2/501
CONTRACT: F30602-72-C-0417, ARPA Order-1279
MONITOR: RADC TR-72-341

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: See also report dated Jul 73, AD-772 639.

DESCRIPTORS: *Optical radar, *Phased arrays, Laser beams, Light transmission, Atmospheric motion, Thermal blooming, Frequency modulators, Optical detectors, Transmitter receivers, Tellurides, Heterodyning, Self organizing systems, Performance tests, Acoustooptics (U)
IDENTIFIERS: Design, *Atmospheric transmissivity, Coherent Optical Adaptive Techniques, Atmospheric attenuation, Adaptive optics (U)

This report summarizes the design specifications and operating properties of the individual components employed in a 6 element linear COAT experimental array. This array employs a phase conjugate principal to adaptively compensate for both receive and transmitting wavefront aberrations induced by the atmosphere, the target and/or the optical system itself. Inherent in the adaptive operations of the COAT array is its ability to select, focus to and track a single glint in a multiglint moving target environment. The report includes test results for the frequency modulator, detector, laser and electronics subsystems. The key element, frequency modulator, has been thoroughly tested with performance meeting theoretically defined specifications. PbSnTe detectors are now being used for heterodyne recievers and have replaced Ge:Cu devices with their attendant requirement for liquid helium. Initial system test results are given along with a system modification which has been made. Performance is close to predicted values and signal-to-noise evaluation for the 1 Km range (U)

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DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOMO7

AD-A025 668 17/5 20/6
ROCKWELL INTERNATIONAL ANAHEIM CALIF ELECTRONICS GROUP

Coherent Optical Adaptive Techniques (COAT). (U)

DESCRIPTIVE NOTE: Final technical rept.,
FEB 73 123P Hayes,C. L. ;Brandewie,R. A. ;Davis,W. C. ;Mevers,G. E. ;SooHoo, J. ;
REPT. NO. C72-731/501
CONTRACT: F30602-72-C-0417, ARPA Order-1279
MONITOR: RADC TR-73-95

UNCLASSIFIED REPORT

DESCRIPTORS: *Optical radar, *Phased arrays, Lasers, Self organizing systems, Phase shift, Variations, Infrared detectors, Target acquisition, Wavefronts, Fabrication, Test methods, Heterodyning, Transmitter receivers, Computerized simulation (U)
IDENTIFIERS: Coherent Optical Adaptive Techniques, Atmospheric attenuation, Atmospheric transmissivity, Glint, Adaptive optics (U)

COAT (Coherent Optical Adaptive Techniques) is the name given to an optical phased array transceiver system which automatically compensates for atmospheric distortion along the propagation path of the beam (turbulence, thermal blooming, laser amplifier). Based upon the principal of transmitting a wavefront which is the phase conjugate of the received wavefront, the COAT system can lock onto and track a target of very small dimension under conditions in which a conventional single-element system would fail or perform poorly. That is, energy can be focused at the target. A previous experiment successfully demonstrated the concept for a two-element system. This report describes the implementation and test results of a multiaperture (1x6) array operating at a wavelength of 10.6 micrometers. Temporal and spatial information from the intensity distributions developed at ranges of 1 km and 10 km are presented as an evaluation of system performance. A theoretical prediction of system operation through computer simulation has also been made and shows the system to be operating near the theoretical limit. (U)

AD-A025 418 20/6 17/9 20/5
UNITED TECHNOLOGIES RESEARCH CENTER EAST HARTFORD CONN

High-Power Infrared Waveguide Modulators. (U)

DESCRIPTIVE NOTE: Semi-annual technical rept. no. 7, Sep 75-Mar 76,
MAR 76 70P Cheo,P. K. ;Fradin,D. ; Gilden,M. ;Wagner,R. ;
REPT. NO. UTRC/R76-922241-3
CONTRACT: N00014-73-C-0087, ARPA Order-1860

UNCLASSIFIED REPORT

DESCRIPTORS: *Light modulators, *Optical radar, *Infrared communications, Carbon dioxide lasers, High power, Far infrared radiation, Broadband, Data rate, K band, Laser beams, Waveguides (U)
IDENTIFIERS: Infrared modulators, Infrared waveguides, Waveguide modulators, Optical modulators (U)

The objective of this program is to develop an efficient and reliable ultrawideband waveguide modulator for CO2 lasers that will be useful for high resolution, imaging optical radars and high-data-rate optical communication systems. Efficiency and reliability are obtainable by using integrated optics technology. During this report period (September 1975 to March 1976), major objectives are (1) to obtain the sideband power at a frequency 16 GHz offset from a CO2 laser V-R transition greater than 10 mW, (2) to obtain a modulation bandwidth exceeding 500 MHz, (3) to obtain a good transmitted optical beam quality, and (4) to establish an optimum waveguide modulator configuration and define the operational capabilities and limitations of this modulator. These research and development efforts are essential for making an accurate assessment of active infrared waveguide devices that shall lead to a rational decision regarding the advisability of initiating a high-power infrared waveguide modulator brassboard development program. (U)

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DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD-A024 557 20/5 17/8 19/5
MASSACHUSETTS INST OF TECH LEXINGTON LINCOLN LAB

Pulsed Laser Ranging Techniques at 1.06 and 10.6 Micrometers. (U)

DESCRIPTIVE NOTE: Project rept.,
MAR 76 46P Becherer,Richard J. ;
REPT. NO. TT-8
CONTRACT: F19628-76-C-0002, ARPA Order-2752
MONITOR: ESD TR-76-69

UNCLASSIFIED REPORT

DESCRIPTORS: *Pulsed lasers, *Range finding, *Optical radar, *Infrared lasers, *Ordnance locators, Carbon dioxide lasers, Neodymium lasers, YAG lasers, Performance(Engineering), Light transmission, Atmospheres, Scintillation, Turbulence, Signal to noise ratio, Heterodyning, Far infrared radiation, Intermediate infrared radiation, High velocity, Projectiles, Optical tracking (U)
IDENTIFIERS: Middle infrared region, HOWLS(Hostile weapons location system), Hostile weapons location system, Neodymium YAG lasers (U)

Heterodyne and direct detection pulsed laser range finders at both 1.06 and 10.6 micrometers are compared. The application involves a transmitter/receiver at ground level ranging on unresolved high velocity projectiles which appear a few degrees above the horizon at ranges up to 10 km. The analysis includes effects of backgraounds, atmospheric turbulence, atmospheric attenuation and target surface characteristics. Available and projected CO2 and Nd:YAG laser power levels are assessed to determine expected operating ranges for each system. (Author) (U)

AD-A024 310 17/8 17/9 20/5
MASSACHUSETTS INST OF TECH LEXINGTON LINCOLN LAB

Diffuse Target Scintillation in 10.6-Micrometer Laser Radar. (U)

DESCRIPTIVE NOTE: Project rept.,
MAR 76 76P Tomczak,Steven P. ;
REPT. NO. TT-9
CONTRACT: F19628-76-C-0002, ARPA Order-2752
MONITOR: ESD TR-76-63

UNCLASSIFIED REPORT

DESCRIPTORS: *Optical radar, *Scintillation, Images, Moving target indicators, Heterodyning, Receivers, Diffusion, Reduction, Glint, Probability distribution functions (U)
IDENTIFIERS: *Laser radar, Howls project, Speckle (U)

This study is concerned with effects of diffuse target scintillation on 10.6-micrometer heterodyne line scan systems where the objective was to identify the problem areas which would eventually control the limiting factors in the image and MTI performance of line scan systems. In particular, diffuse target scintillation (speckle) was recognized as one of the limiting factors for a heterodyne receiver design and this study is concerned with the statistics of speckle noise and with speckle reduction techniques. (Author) (U)

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DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOM07

AD-A024 186 17/8
MASSACHUSETTS INST OF TECH LEXINGTON LINCOLN LAB

Coherent Laser Radar. (U)

DESCRIPTIVE NOTE: Journal article,
75 5P Kingston,Robert H. ;
Sullivan,Leo J. ;
REPT. NO. MS-4092
CONTRACT: F19628-73-C-0002, ARPA Order-600
MONITOR: ESD TR-76-43

UNCLASSIFIED REPORT

Availability: Pub. in the Society of Photo-Optical Instrumentation Engineers, v69 p10-13 1975.

DESCRIPTORS: *Optical radar, *Carbon dioxide lasers, Coherent radar, Infrared detectors, Duplexers, Retroreflectors, Scientific satellites, Heterodyning, Reprints (U)

Coherent laser radar, operating at 10.6 micrometer wavelength, utilizes a CO_2 laser oscillator and amplifier as well as an infrared isolator, mechanical duplexer, and a heterodyne mercury-cadmium-telluride detector. Although limited to clear weather conditions, the high Doppler sensitivity, 2 kHz/cm/sec, and narrow beamwidth, 10 microradians, result in extremely precise velocity and angle measurements. An operating system is described with application to measurements on the retroreflector-equipped satellite, GEOS-C. (Author) (U)

AD-A023 997   17/5   17/8
SCIENCE APPLICATIONS INC HUNTSVILLE ALA

Laser Radar Signature Measurements 10.6 Micrometers Receiver Modification and Interfacing. (U)

DESCRIPTIVE NOTE: Final rept.
MAR 76   13P
REPT. NO. SAI-77-538-HU
CONTRACT: DAAH01-76-A-0021

UNCLASSIFIED REPORT

DESCRIPTORS: *Infrared receivers, *Optical radar, Interfaces, Modification, Heterodyning, Logarithmic amplifiers, Intermediate frequency amplifiers, Far infrared radiation, Fourier spectrometers, Infrared receivers (U)

This task has two principal objectives, both of which involved modification and addition to the 10.6 micrometers receiver for the LSMFT program. One objective of this task was to modify the receiver to provide a logarithmic representation of the 10.6 micrometers detector output, while the second objective was to provide the electronics necessary to interface the 10.6 micrometers receiver with a Fourier Analyzer (HP 5451B). (U)

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DDC REPORT BIBLIOGRAPHY   SEARCH CONTROL NO. ZOM07

AD-A023 479   20/5   17/8
HUGHES RESEARCH LABS MALIBU CALIF

COAT Measurements and Analysis. (U)

DESCRIPTIVE NOTE: Final technical rept. 1 Jul 74-1 Jul 75,
MAR 76   106P   Pearson, James E. ;Brown, W. P. , Jr.;Kokorowski, A. ;Pedinoff, M. E. ; Yeh, C. ;
CONTRACT: F30602-75-C-0001, ARPA Order-1279
MONITOR: RADC TR-76-55

UNCLASSIFIED REPORT

DESCRIPTORS: *Lasers, *Phased arrays, *Optical radar, Adaptive systems, Measurement, Computerized simulation, Optics, Active systems, Thermal blooming, Turbulence, Focusing, Modulation (U)
IDENTIFIERS: *COAT(Coherent optical adaptive techniques), Coherent optical adaptive techniques, Speckle modulations (U)

Coherent optical adaptive techniques (COAT) have been studied by experiment, by analysis, and by computer simulation. The experiments have utilized a 21-channel, visible-wavelength, multidither COAT system, while the computer simulations have dealt with both multidither (outgoing-wave) and phase-conjugate (return-wave) systems. Thermal blooming and turbulence distortions and complex-target effects (speckle-modulations) have been studied. This report summarizes the status of the 21-channel DARPA/RADC, visible-wavelength, multidither COAT experimental model and associated hardware and its use in the experimental measurements on this contract. Experimental observations with the 21-channel COAT system show that blooming distortions occurring in the first 30% of the focused propagation path can be compensated, leading to roughly a factor of 1.5 increase in peak focused-beam irradiance. Computer simulation of phase-conjugate (return-wave) COAT systems has shown almost no blooming compensation. Experimental measurements of COAT operation with equal transmitter and receiver apertures and semidiffuse, extended-glint scotchlight surfaces have failed to produce any degradation in the system convergence level, (U)

AD-A022 714 20/5
JOHNS HOPKINS UNIV LAUREL MD APPLIED PHYSICS LAB

Prospects for Precision Active Tracking using a Quadrant Detector. (U)

DESCRIPTIVE NOTE: Technical memorandum,
JAN 76 61P Walter,J. F. ;
REPT. NO. APL/JHU/TG-1290
CONTRACT: N00017-72-C-4401

UNCLASSIFIED REPORT

DESCRIPTORS: *Laser tracking, *Neodymium lasers, *Optical radar, Guided missile tracking systems, Aircraft, Leading edges, Infrared transmitters, Avalanche diodes, Photodiodes, Atmospherics, Errors, Quadrants, Signal to noise ratio, Signal processing (U)
IDENTIFIERS: *Quadrant detectors, Neodymium YAG lasers (U)

A general modal is developed for an active quadrant tracking system constrained to track the nose or leading edge of incoming missiles and aircraft. The basic system consists of a shortpulse Nd:YAG 1.06-micrometer laser transmitter and a laser receiver with a quadrant avalanch photodiode detector in a direct detection mode. Using the model with carefully selected target, atmospheric, system, and detector parameters, estimates are made of the random tracking errors to be expected under various conditions. The conditions are noted under which tracking errors of 10 micro rad. (maximum) can be expected. (Author) (U)

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DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOMO7

AD-A022 563 17/8 14/5
MICHIGAN UNIV ANN ARBOR DEPT OF ELECTRICAL AND COMPUTER ENGINEERING

Super-Resolution of Rotating Objects. (U)

DESCRIPTIVE NOTE: Final rept. Dec 74-Dec 75,
JAN 76 16P Aleksoff,C. C. ;
CONTRACT: DAHC04-75-G-0054
MONITOR: ARO 12374.2-R-EL

UNCLASSIFIED REPORT

DESCRIPTORS: *Optical detection, *Optical images, *Holography, Optical radar, Resolution, Interferometry, Laser beams, Moving targets, Apertures (U)
IDENTIFIERS: Interferometric holography, Laser detection and ranging (U)

It is shown that if an object passes through an interference field then a one-dimensional image can be formed along the direction of motion via synthetic aperture techniques. This technique, labeled Synthetic Interferometer Imaging depends on electronically detecting the intensity of the time varying signal scattered by the object. This detected signal is then, in general, match filtered to give the image. This technique was demonstrated using interference between two laser beams of the Hermite-Gaussian type with different transverse order number. For the case where the interference field is formed by two coherent point sources a spatial recording of the detected signal produces a simple hologram of the object. The effective (synthetic) aperture of this hologram and hence the image resolution is proportional to the recording time and is also dependent on the geometry of the system. (U)

AD-A022 471 4/2 17/8
WISCONSIN UNIV MADISON DEPT OF METEOROLOGY

Studies of Structure in the Planetary Boundary Layer with a High Resolution Lidar. (U)

DESCRIPTIVE NOTE: Summary rept. 15 Aug 72-14 Aug 75,
JAN 76 80P Eloranta,E. W. ;Weinman,J. A. ;
CONTRACT: DA-ARO-D-31-124-73-G29
MONITOR: ARO 10967.3-EN

UNCLASSIFIED REPORT

DESCRIPTORS: *Wind, *Optical radar, Boundary layer, Infrared pulses, Aerosols, Eddy currents, High resolution (U)
IDENTIFIERS: *Lidar (U)

The following report is a summary of studies on planetary boundary layer visualization and remote determination of wind profiles by means of a high resolution lidar. These investigations rely on inhomogeneities in the natural aerosol distribution to delineate eddies in the boundary layer. Measurement of the rate of displacement of these eddies yield horizontal wind components. (Author) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOMO7

AD-A021 746 17/8 20/6 20/5
HUGHES RESEARCH LABS MALIBU CALIF

Hydraulic Actuators for Active Optical Systems. (U)

DESCRIPTIVE NOTE: Final technical rept. 1 Oct 74-22 Jun 75,
AUG 75 46P Hansen,S. ;
CONTRACT: N60921-75-C-0067

UNCLASSIFIED REPORT

DESCRIPTORS: *Optical radar, *Lasers, *Phase shift, *Hydraulic actuators, Molybdenum, Phased arrays, Control systems, Computerized simulation, Fluid flow, Computer programs, Cooling, FORTRAN (U)
IDENTIFIERS: Design, Coherent Optical Adaptive Techniques (U)

A fast response, high accuracy, compact hydraulic actuator has been developed and demonstrated for applications that require actuators providing moderate speed, high force, and large optical path length excursions, e.g., as a mirror driver in an adaptive optical system. The actuator is characterized by a -3 dB response bandwidth of 670 Hz when operated at a supply pressure of 3000 psi, and a total excursion of 42.4 micrometers, which corresponds to plus or minus 4 wavelengths of phase shift at 10.6 micrometers when used as a mirror driver. The actuator was tested in a deformable faceplate fixture that simulates nine actuator positions at a modular spacing of 2 cm (0.8 in.). Plots are given of measured mirror surface profiles and contours. A computed contour plot is given for comparison. Also included is a program for computer simulation of the actuator in a complete multichannel, multidither COAT control system. (U)

AD-A021 631   15/3.1   17/5
ROME AIR DEVELOPMENT CENTER GRIFFISS AFB N Y

Laser Radar Signatures of RV Models of Interest in Ballistic Missile Defense, (U)

FEB 76   117P   Michels,James H. ;Bromley, Eugene E. ;Demma,Fred J. ;
REPT. NO. RADC-TR-75-319

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: Sponsored in part by Army Advanced Ballistic Missile Defense Agency, Washington, D.C.

DESCRIPTORS: *Infrared detectors, *Optical radar, *Antimissile defense systems, Target acquisition, Infrared signatures, Transmitter receivers, Radar signatures, Infrared lasers, Surface roughness, Laser target designators, Flat plate models, Coatings, Carbon dioxide lasers, Reentry vehicles, Intermediate infrared radiation (U)

A series of measurements were conducted on laser backscatter characteristics from modeled RV and decoy targets of interest to Ballistic Missile Defense (BMD). Bidirectional reflectance measurements were made on the various surface materials. The experimental results were compared with an in-house analytical model (BKSCAT) which predicts backscatter levels based upon flat plate bidirectional reflectance measurements. The agreement between the experimental and analytical results ranges from excellent to poor. Good agreement was obtained for targets from which representative flate plate reflectance data can be obtained. (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY   SEARCH CONTROL NO. ZOMO7

AD-A019 710   4/2   17/8
FRAUNHOFER-GESELLSCHAFT GARMISCH-PARTENKIRCHEN (WEST GERMANY)

Analysis of Aerosol Transport. (U)

DESCRIPTIVE NOTE: Final technical rept. Jul 74-Jun 75,
JUL 75   93P   Reiter,Reinhold ;Carnuth, Walter ;Littfass,Michael ;Varshneya,N. C. ;
CONTRACT: DA-ERO-591-73-G-0057
PROJ: DA-1-T-161102-BH-57
TASK: 1-T-161102-BH-5701

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: See also report dated Jun 74, AD-A001 606.

DESCRIPTORS: *Aerosols, *Optical radar, *Atmospheric motion, Transport properties, Data acquisition, Calibration, Condensation nuclei, Radioactivity, Laser communications, Optical equipment, Ruby lasers, Telescopes, Signal processing, Backscattering, West Germany (U)
IDENTIFIERS: Remote sensing (U)

The report presents a detailed description of the recently installed, and currently functioning, lidar system, including data acquisition and processing. Extensive mathematical and theoretical procedures have been worked out for calibration of the system, using simultaneously acquired aerosol and aerological data, and for evaluation of the return signals once the system is absolutely calibrated. The procedures are described in detail. Examples of calibration measurements are presented and discussed. (U)

AD-A018 983 20/6 20/5
SPERRY UNIVAC ST PAUL MINN APPLIED PHYSICS LAB

Magneto-Optic Laser Beam Steering. (U)

DESCRIPTIVE NOTE: Technical rept. 1 Mar 74-1 Mar 75,
OCT 75 74P Johansen,T. R. ;Hewitt,F. G. ;Krawczak,J. ;Torok,E. J. ;
CONTRACT: F33615-74-C-1035
PROJ: AF-2001
TASK: 200102
MONITOR: AFAL TR-75-122

UNCLASSIFIED REPORT

DESCRIPTORS: *Laser beams, *Deflectors, *Optical materials, *Magnetooptics, *Beam steering, Ytterbium compounds, Bismuth compounds, Iron compounds, Epitaxial growth, Substrates, Memory devices, Optical radar, Line scanning, Thermal expansion, Fabrication (U)
IDENTIFIERS: Liquid phase epitaxy, Ytterbium iron garnet, Optical crystal memories, Laser beam recorders (U)

An effort to apply magneto-optic laser beam steering to laser recording has been conducted. The approach is based on diffraction of laser beams by stripe domains which exist in bismuth ytterbium iron garnet crystals (BiYbIG). The preparation of BiYbIG crystals by liquid phase epitaxy is complicated by a surprisingly large thermal expansivity of the bismuth substituted garnet. Special substrates, graded interfaces, top seeded rods, bulk crystals, and LPE on very thin (10 micrometer) substrates were tested as a means of crystal fabrication. LPE on very thin substrates appears to be the single best short term approach. With this method, lead free, crack free, high bismuth content garnets were for the first time grown by liquid phase epitaxy. At this time, high inductance (approximately 400 (mu)H) drive coils are required to generate the drive field. An azimuth scan uses a resonant circuit but requires a 25-30 Oe field for scan initiation and so wastes spots. The radial scan uses all of the spots but requires a broad band drive circuit which limits the number of lines available at 30 frames per sec. (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOMO7

AD-A018 706 17/5 20/5
ROCKWELL INTERNATIONAL CORP ANAHEIM CALIF ELECTRONICS RESEARCH DIV

CO2 MTI Laser Radar for Personnel and Vehicular Detection. (U)

DESCRIPTIVE NOTE: Final rept. Dec 73-Jul 75,
DEC 75 61P Hayes,Cecil L. ;
REPT. NO. C74-77/501
CONTRACT: DAAB07-74-C-0063
PROJ: DA-1-S-762703-DH-93
MONITOR: ECOM 75-0063-F

UNCLASSIFIED REPORT

DESCRIPTORS: *Carbon dioxide lasers, *Optical radar, *Infrared detectors, *Moving target indicators, Target acquisition, Heterodyning, Semiconductor devices, Tellurides, Tin compounds, Lead compounds, Experimental design, Defense systems, Mobile, Fabrication, Transmitter receivers, Field tests, Infrared lasers, Intrusion detectors, Personnel detectors (U)
IDENTIFIERS: *Heterodyne detection, Lead tellurides, Tin tellurides (U)

This program addressed the design, fabrication, test, and delivery of a developmental CO2 MTI laser radar. The primary goal was the construction of a feasibility model which could be tripod mounted, easily transported in the field, and yet withstand the rigors of field use without performance degradation. Operationally, the main targets of interest were vehicles and personnel within the range of 1.5 km. The equipment fabricated consisted of two units; laser radar head and power supply/control panel. Complete control of the system from a remote location was provided through an umbilical cable. A programmable scanner was furnished which covered a 30 degree field at rates up to 60 degrees/sec, with scan widths from plus or minus 1 to plus or minus 15 degrees. Pointing accuracy, as well as readout accuracy, of 0.1 degree was implemented. The design accommodates either 115 vac or 28 vdc as the primary power source. A Pb(x)Sn(1-x)Te detector was fabricated. (U)

AD-A015 737 4/2 1/5 20/5
AIR FORCE CAMBRIDGE RESEARCH LABS HANSCOM AFB MASS

Measurement of Cloud Height, Evaluation of Ranging and Triangulation Techniques for Determination of Cloud Height at Airfields. (U)

DESCRIPTIVE NOTE: Final rept.,
MAY 75 17P Moroz,Eugene Y. ;Travers, George A. ;
REPT. NO. AFCRL-AFSG-321, AFCRL-TR-75-0306
PROJ: AF-6670
TASK: 667004

UNCLASSIFIED REPORT

DESCRIPTORS: *Cloud height indicators, *Optical radar, Ruby lasers, Ceiling, Clouds, Landing fields, Light scattering, Comparison, Triangulation (U)
IDENTIFIERS: Ceilometers, Cloud structure (U)

A new evaluation of a ruby lidar ceilometer was performed at AFCRL as part of a program to evaluate the applicability of lasers to determine cloud height for airfield use. Comparitive measurements of cloud height were made with a standard Air Force rotating beam ceilometer (RBC). Examination of the test results shows the lidar indicates an accurate presentation of cloud structure. The RBC cloud return is affected by its geometry and by multiple scatter in the cloud. As a result, the measurement is not a true representation of cloud structure. These effects also bias the RBC to indicate higher cloud heights. However, the difference in cloud heights as measured by the two systems is not significant. Therefore, it is concluded that the lidar is a superior cloud height measuring device and both techniques provide operationally useful indications of cloud height. (Author) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOM07

AD-A015 028 17/9 17/8 16/1 14/2
GEORGIA INST OF TECH ATLANTA ENGINEERING EXPERIMENT STATION

Instrumentation Techniques for Tracking Low-Flying Vehicles. (U)

DESCRIPTIVE NOTE: Final rept. 1 Sep 74-10 Jul 75,
JUL 75 135P Robinette,S. L. ;Rhodes,J. E. , Jr.;Wetherington,R. D. ;Reedy,E. K. ; Hayes,r. D. ;
REPT. NO. GIT-A-1678-F
CONTRACT: DAAD07-75-C-0025
PROJ: GIT-A-1678

UNCLASSIFIED REPORT

DESCRIPTORS: *Guided missile tracking systems, *Radar tracking, *Optical tracking, *Range finding, New Mexico, Guided missile ranges, Instrumentation, Tracking, Low altitude, Aircraft, Guided missiles, Millimeter waves, Radar equipment, Optical radar, Terrain avoidance, Airborne (U)
IDENTIFIERS: White Sands Missile Range (U)

An anlysis and evaluation has been made of available range instrumentation which would permit White Sands Missile Range to measure performance of low-flying missiles and aircraft, with the following accuracy objectives: 10 feet in position, any axis; 5 feet per second, in velocity; and 5 feet per second in acceleration. A configuration was analyzed which used range measurements from ground sites to determine the position of an overflying aircraft, and tracking (measurements of range and pointing angles from the aircraft to the test vehicle) to determine the position of the low-flying vehicle. An inertial measurement unit, an altimeter, and a digital processor in the aircraft would establish attitude of the airborne reference system. No available airborne tracking equipment was found which would meet the White Sands Missile Range requirements. Both millimeter and laser airborne radars were evaluated as candidates for device development programs, to perform the function of airborne tracking. The possibility was examined of using an available Ku band airborne radar to determine altitude with 10 foot accuracy. (U)

AD-A013 424 20/5 14/5 17/8
RIVERSIDE RESEARCH INST NEW YORK

Laser Correlography: Transmission of High-Resolution Object Signatures Through the Turbulent Atmosphere. (U)

DESCRIPTIVE NOTE: Technical rept.,
OCT 74 120P Elbaum,M. ;King,Marvin ;
Greenebaum,M. ;
REPT. NO. RRI-T-1/306-3-11
CONTRACT: DAAH01-74-C-0419, ARPA Order-2281

UNCLASSIFIED REPORT

DESCRIPTORS: *Lasers, *Holography, *Optical signatures, Holograms, Automatic, Correlation techniques, Two dimensional, High resolution, Turbulence, Atmospheric motion, Signal to noise ratio, Laser beams, Laser target designators, Ruby lasers, Illumination, Transmitters, Light transmission, Infrared lasers, Atmospheres, Scintillation, Optical radar, Space objects, Carbon dioxide lasers, Backscattering (U)
IDENTIFIERS: *Laser correlography, Laser holography, Laser speckle, *Atmospheric attenuation (U)

A correlogram is the two-dimensional autocorrelation of the image of an object illuminated with non-coherent radiation. A laser correlogram is obtained from the power spectrum of the irradiance pattern scattered from the object when illuminated with sufficiently coherent radiation. The resolution of this signature is dictated by the size of the receiving aperture, with relatively minor degradation by atmospheric turbulence. This report collects in one place information which has been available up to now only in conference proceedings or in limited-circulation Research Notes of the Riverside Research Institute. The subjects treated analytically include: a model for laser backscattering, studies on the influence of atmospheric turbulence on the laser correlogram, statistical convergence properties of the laser correlogram signature, qualitative experimental laboratory results, and the outline of a design for a ruby-laser experiment using space objects. (Author) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOMO7

AD-A012 346 4/2 17/7
TRANSPORTATION SYSTEMS CENTER CAMBRIDGE MASS

Fog Bank Detector Field Tests: A Technical Summary. (U)

DESCRIPTIVE NOTE: Technical rept. Sep 71-Dec 71,
DEC 71 36P Lifsitz,Jack R. ;Yaffee,
Melvin Y. ;
REPT. NO. TSC-USCG-72-2
CONTRACT: DOT-CG-202

UNCLASSIFIED REPORT

DESCRIPTORS: *Fog, *Optical radar, *Optical detectors, Ruby lasers, Gallium arsenide lasers, Radiometers, Infrared detectors, Background, Radiance, Reliability(Electronics), Backscattering, California, Performance(Engineering) (U)
IDENTIFIERS: DOT/4GZ/GA, DOT/4IZ/IE, Point Bonita, Design, *Fog bank detectors (U)

The report summarizes the results of field experiments performed at Pt. Bonita, California. The system under study, a laser LIDAR and a vertical-scanning infrared radiometer, have been discussed in detail in Report No. DOT-TSC-CG-71-3. Measurements of the peak power and shape of the return LIDAR pulse, and of the background levels, support the assumptions made in that report. The largest value of background spectral radiance measured, when a sunlit cloud fills the LIDAR receiver field-of-view, is 2 micro w/sq cm/A/sr (at 6943A). The infrared radiometer was found to be susceptible to ambiguities serious enough to eliminate this method from use as a reliable fog detector at the present time. Based on the laser backscatter results, a LIDAR fog bank detector, using a GaAlAs laser diode array as the transmitting source, is recommended and conclusions regarding its technical performance are presented. (U)

AD-A012 259 17/8 20/5 17/3
PENNSYLVANIA STATE UNIV UNIVERSITY PARK

Detection Statistics for Laser Radar in Atmospheric Turbulence with Fluctuating Targets, (U)

JUL 74 5P Lachs,Gerard ;Miner,Mark C. ;
CONTRACT: DAHC04-73-C-0036
MONITOR: ARO 11758.1-EL

UNCLASSIFIED REPORT

Availability: Pub. in IEEE Transactions on Aerospace and electronic Systems, vAES-11 n2 p234-237 Mar 75.

DESCRIPTORS: *Optical radar, *Lasers, Detection, Probability, Background radiation, Atmospheric motion, Turbulence, Targets, Oscillation, Reprints (U)

The probability of detection and false-alarm rates are developed for laser radar systems perturbed by background radiation, fluctuating targets, and atmospheric turbulence. In particular, some results on the decibel loss due to atmospheric turbulence are presented. (Author) (U)

AD-A011 917 17/5 17/8 22/3
GENERAL RESEARCH CORP MCLEAN VA

Space Object Laser Analysis - 2 (SOLA). (U)

DESCRIPTIVE NOTE: Final technical rept.,
MAY 75 244P Gurski,G. F. ;Peters,W. N. ;Radley,R. J. , Jr.;Schultz,N. H. ;
REPT. NO. 490W-01-CR
CONTRACT: F30602-74-C-0119
PROJ: AF-6527
TASK: 652701
MONITOR: RADC TR-75-141

UNCLASSIFIED REPORT

DESCRIPTORS: *Optical radar, *Space surveillance systems, *Infrared detection, Infrared signatures, Target signatures, Signal processing, Optical detectors, Optical tracking, Doppler radar, Identification systems, Space objects, Computer applications, Carbon dioxide lasers (U)
IDENTIFIERS: SOLA(Space Object Laser Analysis), Space Object Laser Analysis (U)

The object of this study was to definitize conceptual descriptions of laser radar functions identified during the original SOLA study. The work reported here is a compilation of analyses performed on individual study tasks including: quasi-resolved target effects, satellite laser radar cross-section modeling, signature effects on detection probability, CORAL (Coherent Optical Radar Laboratory) aquisition software, and multi-sensor SOI (Space Object Identification). (U)

AD-A011 707 20/6 17/5 17/8
HUGHES RESEARCH LABS MALIBU CALIF

COAT Measurements and Analysis. (U)

MAY 75 45P Pearson,James E. ;
CONTRACT: F30602-75-C-0001, ARPA Order-1279
MONITOR: RADC TR-75-101

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: See also AD-A006 105.

DESCRIPTORS: *Optical radar, *Phased arrays, *Thermal blooming, Lasers, Self organizing systems, Control systems, Gas cells, Electronic equipment, Adaptive systems, Acoustooptics, Wind machines, Test equipment, Computerized simulation, Atmospheric motion, Optical equipment, Target discrimination, Laboratory tests (U)
IDENTIFIERS: COAT(Coherent Optical Adaptive Techniques), Coherent Optical Adaptive Techniques, Atmospheric attenuation (U)

Compensation for thermal blooming distortions has been studied using multidither coherent optical adaptive techniques (COAT) in scaled laboratory experiments. An 18 element, visible wavelength, COAT systems was able to effect only a small improvement in peak target irradiance for forced-convection blooming. Similar results were observed with a truncated Gaussian beam using a computer simulation which models atmospheric thermal blooming and uses a phase conjugate COAT control algorithm to adjust the transmitted beam phase. Refinements in the experimental apparatus to eliminate buoyancy effects are discussed and a design is presented for incorporating adaptive pointing and focus controls into the COAT system. Two designs for an artificial turbulence generator are presented along with a design for adding adaptive tracking and focus controls to the RADC/COAT system. Preliminary COAT studies without turbulence or blooming but with complex moving targets are reported. Normal COAT system operation is observed with all targets if the receiver has sufficient resolution and if the system signal-to-noise ratio is large enough for stable operation. (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOMO7

AD-A010 926 17/8 20/5 20/6
LEAR SIEGLER INC SANTA MONICA CALIF ASTRONICS DIV

Laser Radar Development. (U)

DESCRIPTIVE NOTE: Final rept.,
FEB 69 24P
REPT. NO. ADR-736
CONTRACT: N00014-66-C-0157

UNCLASSIFIED REPORT

DESCRIPTORS: *Optical radar, Oceanography, Range gating, Search radar, Performance tests, Q switching, Ruby lasers, Neodymium lasers, Doping, Image processing, Test equipment, Cameras, Infrared lasers, Yttrium compounds, Aluminates, Yttrium aluminum garnet, Pulsed lasers (U)
IDENTIFIERS: Design, Q switched lasers, Neodymium glass lasers, YAG lasers (U)

The objective of this program was to develop a laser radar system applicable to the problem of detection at sea, and the mission of search and locate. The program included the following phases: The construction, test, and evaluation of a range-gated imaging system (RGI-Mod I) consisting of a three- or four-joule Q-switched laser and gated image intensifier system; Field testing of the RGI-Mod I system at the Chesapeake Bay Naval Research Laboratory to determine the effects of whitecap sea conditions on the system operation; The development of a high average power-pulsed solid-state laser that could be used in range-gated or plan position-indicating optical radar. The investigation included cooling of both the inside and outside of a cored cylindrical laser rod as well as studies involving ruby, neodymium doped glass and neodymium doped YAG. (U)

AD-A010 472   20/5   20/6   17/2
MARTIN MARIETTA AEROSPACE ORLANDO FLA

Wideband Intermediate Laser Amplifier Techniques. (U)

DESCRIPTIVE NOTE: Final rept. 10 Jan-15 Oct 74,
APR 75   56P   Martin,James M. ;Smith, William T. ;Crabbe,Ira C. ;
CONTRACT: F30602-74-C-0098
PROJ: AF-6527
TASK: 652703
MONITOR: RADC TR-75-99

UNCLASSIFIED REPORT

DESCRIPTORS: *Optical radar, *Laser modulators, *Carbon dioxide lasers, *Laser amplifiers, Frequency modulation, Bandwidth, Chirp filters, Infrared lasers, Laser cavities, Light pulses, Gain, Coherent radiation, Transmitters, Electrooptics, Gas ionization, Excitation, Electric discharges, Waveforms, Optical waveguides (U)
IDENTIFIERS: Design, Waveguide lasers (U)

This contract falls in the area of laser radar transmitter technology, since it was an engineering study of a wideband intermediate stage laser amplifier, using laboratory hardware, to verify predicted performance, and arrive at a conceptual design for a practical device. This type of amplifier is needed for the implementation of several types of high resolution laser radar systems. The amplifier would be capable of amplifying frequency swept synthetic imaging radar waveforms of microseconds duration and 500 MHz sweep extent, generated by a master oscillator, to a level sufficient to drive a laser power amplifier. The conceptual design resulting from this study calls for a 200 torr laser gas pressure, a pulse/RF gas discharge ionization/excitation technique, and a closed cycle, flowing gas, transverse discharge, transverse cavity laser configuration in order to meet the waveform amplification requirements. (U)

AD-A008 269   20/6   4/1
STANFORD RESEARCH INST MENLO PARK CALIF

Tactical Considerations of Atmospheric Effects on Laser Propagation. (U)

DESCRIPTIVE NOTE: Quarterly status rept. no. 2, 13 Apr-12 Jul 68,
AUG 68   48P   Uthe,Edward E. ;Allen, Robert J. ;
CONTRACT: N00019-68-C-0201
PROJ: SRI-7165

UNCLASSIFIED REPORT

DESCRIPTORS: *Optical radar, *Laser beams, *Target designators, Atmospheric motion, Neodymium lasers, Mie scattering, Surface waves, Water vapor, Light transmission, Spectral energy distribution (U)
IDENTIFIERS: *Atmospheric attenuation (U)

Power spectral density estimates of Mie backscatter efficiency factors computed over a range of size parameters from 0.1 to 100 in increments of 0.1 for the refractive index of 1.33 are presented. The power spectral densities are interpreted in terms of geometrical rays. It is concluded that the backscattering is dominated by surface waves which can explain much of the low- and high-frequency Fourier terms. Important implications as applied to the problem of predicting atmospheric transmission and atmospheric false targets from backscattered laser energy are presented. Modification of the SRI Mark VI Lidar for the purpose of transmitting and receiving two-wavelength (0.53 and 1.06 micrometers) energy is described. As a preliminary step, recorded lidar signatures of the output from the two independent receivers in 1.06-micrometers configuration are compared. (U)

AD-A007 032 17/8 20/6
HUGHES RESEARCH LABS MALIBU CALIF

Coherent Optical Adaptive Techniques (COAT). (U)

DESCRIPTIVE NOTE: Quarterly technical rept. no. 5 (Final),
JAN 75 151P Pearson,J. E. ;Bridges,W. B. ;Horwitz,L. S. ;Kubo,R. M. ;Walsh,T. J. ;
CONTRACT: F30602-73-C-0248, ARPA Order-1279
MONITOR: RADC TR-75-46

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: See also report dated Apr 74, AD-783 281.

DESCRIPTORS: *Optical radar, *Phased arrays, Lasers, Computerized simulation, Self organizing systems, Laser beams, Atmospheric motion, Diffraction, Optical tracking (U)
IDENTIFIERS: Atmospheric attenuation, COAT(Coherent Optical Adaptive Techniques), Coherent optical adaptive techniques, Glint (U)

There are two primary objectives of this program. The first objective is to determine the performance limits of coherent optical adaptive techniques through operation of an experimental, visible prototype multidither COAT system through a representative turbulent atmosphere against a complex dynamic target. The second objective is to determine the best methods of employing COAT in high power laser systems and to assess the status of necessary key high power components. This report covers the range measurements phase of the contract during which detailed studies were made on COAT compensation for atmospheric turbulence using the 18-element visible system developed earlier in the contract. (U)

AD-A006 105 20/6 17/5 17/8
HUGHES RESEARCH LABS MALIBU CALIF

COAT Measurements and Analysis. (U)

DESCRIPTIVE NOTE: Quarterly technical rept. no. 1, 2 Jul-1 Oct 74,
FEB 75 48P Pearson,J. E. ;
CONTRACT: F30602-75-C-0001
MONITOR: RADC TR-75-47

UNCLASSIFIED REPORT

DESCRIPTORS: *Optical radar, *Phased arrays, *Thermal blooming, Lasers, Self organizing systems, Control systems, Gas cells, Electronic equipment, Adaptive systems, Acoustooptics, Wind machines, Computerized simulation, Atmospheric motion, Optical equipment, Target discrimination, Theses (U)
IDENTIFIERS: COAT(Coherent Optical Adaptive Techniques), Atmospheric attenuation (U)

Coherent Optical Adaptive Techniques (COAT) offer promise in overcoming beam distortions experienced by high power optical beams propagating in a turbulent absorbing atmosphere. This report describes the first phase of a program to evaluate the effectiveness of multidither COAT in eliminating thermal blooming distortions. An absorbing gas cell, wind generation mechanism, and gas handling station have been constructed for use in visible wavelength laboratory experiments. An optical system has been designed and built which will produce beam parameters and blooming levels which can be scaled to interesting scenarios at 10.6 micrometers. Preliminary measurements of blooming compensation using an 18-element, 0.488 micrometers COAT system have been made with a thin static, liquid-filled cell as the blooming medium. The COAT system increased the target irradiance by more than a factor of 10 and reduced the beamwidth by a factor of 5.4 from the uncorrected bloomed case. (U)

AD-A003 995 4/2
ARMY ELECTRONICS COMMAND FORT MONMOUTH N J

A Transit-Time Lidar Wind Measurement:
A Feasibility Study. (U)

DESCRIPTIVE NOTE: Research and development technical rept.,
DEC 74 19P Barber,T. L. ;Mason,J. B. ;
REPT. NO. ECOM-5550
PROJ: DA-1-T-061102-B-53-A
TASK: 1-T-061102-B-53-A-19

UNCLASSIFIED REPORT

DESCRIPTORS: *Wind velocity, *Optical radar, Measurement, Short range(Distance) (U)
IDENTIFIERS: Remote sensing (U)

Transit-time lidar is being used experimentally by the Army for remote wind measurement. The system developed at White Sands Missile Range uses lidar backscatter from patterns of irregularities in atmospheric dust concentration to measure the component of the wind normal to the laser beam. The system is described, and experimental data on wind measurements from 2 to 15 m/sec at a range of 250 m are presented. (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOM07

AD-A003 856 17/5 20/5
NAVAL POSTGRADUATE SCHOOL MONTEREY CALIF

FM-CW Laser Radar at 10.6 Microns. (U)

DESCRIPTIVE NOTE: Master's thesis,
DEC 74 117P Chance,Thomas Henry ;

UNCLASSIFIED REPORT

DESCRIPTORS: *Optical radar, *Frequency modulation, Performance(Engineering), Carbon dioxide lasers, Infrared tracking, Laser beams, Experimental design, Theses, Resolution (U)
IDENTIFIERS: Atmospheric attenuation, Laser modulators, Photovoltaic detectors, Continuous wave lasers (U)

The feasibility of a continuous-wave frequency-modulated radar with a CO_2 laser as a transmitting source was investigated. A developmental system was constructed and tested and the feasibility of an optical radar using coherent detection at 10.6 micrometers was demonstrated. The radar had the capability of instantaneous range and velocity determination. (U)

AD-A002 407 4/1 20/5
CALIFORNIA UNIV SAN DIEGO LA JOLLA INST FOR PURE AND APPLIED PHYSICAL SCIENCES

Application of Lasers in Atmospheric Probing. (U)

DESCRIPTIVE NOTE: Technical rept.,
OCT 73 20P Wang,C. P. ;
REPT. NO. IPAPS-73/74-469
CONTRACT: N00014-69-A-0200-6054, DAHC04-72-C-0037
PROJ: ARPA Order-2685

UNCLASSIFIED REPORT
Availability: Pub. in Acta Astronautica, v1 p105-123 1974.
SUPPLEMENTARY NOTE: Prepared in cooperation with Aerospace Corp., Los Angeles.

DESCRIPTORS: *Atmospheric sounding, *Lasers, *Optical radar, Atmospheres, Light scattering, Atmospheric temperature, Aerosols, Light transmission, Mie scattering, Reprints (U)
IDENTIFIERS: Laser radar (U)

A survey on the direct measurement of atmospheric parameters by laser technique is given. Light interactions, which includes Mie, Rayleigh, resonance-fluorescence, and Raman scattering, and light absorption, have been used for the laser probing of atmospheric constituents, temperature profiles, and aerosol distributions. Some basic parameters of the laser radar system, namely, laser light source, photodetector system, atmospheric transmittance, and sky radiation, are discussed. The performance and capability of some existing laser radar systems and some possible future systems are also discussed. (Author) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOMO7

AD-A001 971 20/5 17/8 20/6 17/5
MASSACHUSETTS INST OF TECH LEXINGTON LINCOLN LAB

Optics Research: 1974:1. (U)

DESCRIPTIVE NOTE: Semiannual rept. 1 Jan-30 Jun 74,
JUN 74 53P Rediker,Robert H. ;
CONTRACT: F19628-73-C-0002, ARPA Order-600
MONITOR: ESD TR-74-235

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: See also AD-779 917.

DESCRIPTORS: *Gas lasers, *Optical instruments, *Optical radar, Laser beams, Light transmission, Atmosphere models, Thermal blooming, Carbon dioxide lasers, Infrared lasers, Interferometers (U)
IDENTIFIERS: *Hydrogen fluoride lasers, Atmospheric attenuation (U)

Contents: Laser technology and propagation--Pulse propagation, effects, and devices; Optical measurements and instrumentation--Interferometric image evaluation, and long-path monitoring of atmospheric carbon monoxide by a tunable diode laser system. (U)

AD-A001 638 17/8 17/5
OWENS-ILLINOIS INC PITTSBURGH PA FECKER SYSTEMS DIV

Optical Racar Angle Tracking Mount. (U)

DESCRIPTIVE NOTE: Final rept. Jul 73-Jul 74,
SEP 74 86P Thompson,George J. ;Pappas,
Spiro ;Zvilna,Andrew S. ;
REPT. NO. F(4)-864-047-022-2251A
CONTRACT: F30602-72-C-0192, ARPA Order-1279
MONITOR: RADC TR-73-205-Add

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: See also AD-765 213.

DESCRIPTORS: *Optical radar, *Mounts, Mirrors, Tracking, Beams(Radiation), Servomechanisms, Transfer functions, Bearings (U)
IDENTIFIERS: Coelostats (U)

The report consists of: Hydrostatic bearing tests, azimutn and elevation; Servo Transfer functions; and Summary of test results for the optical radar angle tracking mount. (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOMO7

AD-A001 606 4/2
FRAUNHOFER-GESELLSCHAFT GARMISCH-PARTENKIRCHEN (WEST GERMANY)

Analysis of Aerosol Transport. (U)

DESCRIPTIVE NOTE: Annual rept. Jul 73-Jun 74,
JUN 74 89P Reiter,Reinnold ;Carnuth,
Walter ;Kanter,Hans Joachim ;Sladkovic,Rudolf ;
CONTRACT: DA-ERO-591-73-G-0057
PROJ: DA-1-T-061102-B-53-A

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: *Aerosols, *Optical radar, Temperature, Concentration(Composition), Reflectivity, Altitude, Profiles, Condensation nuclei, Humidity, Atmospheric sounding, Data acquisition, Experimental design, West Germany (U)

A system is described which permits the systematic comparing between Lidar reflectivity on the one hand, and aerosol concentration as well as aerological data, on the other hand, taking advantage of the alpine situation (high mountain stations, cable cars used as instrument carriers). The Lidar unit is described. Results are discussed using simultaneously obtained Lidar reflectivity profiles and profiles of aerosol concentration (condensation nuclei), plus temperature and humidity lapse rates. Very good agreement is found between Lidar reflectivity and logarithm of number of condensation nuclei. With high relative humidities some influence of the growth of the particles is noted which, however, is not sufficient in general to describe Lidar reflectivity profiles. (U)

AD-A001 565 4/2 17/8
TRANSPORTATION SYSTEMS CENTER CAMBRIDGE MASS

Lidar Systems for Measuring Visibility. A Technical Assessment. (U)

DESCRIPTIVE NOTE: Final rept. Jul 73-Mar 74,
SEP 74 68P Lifsitz,J. R. ;
REPT. NO. TSC-FAA-74-15
MONITOR: FAA-RD 74-149

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: See also report dated Mar 74, AD-777 533.

DESCRIPTORS: *Visibility, *Optical radar, Signal processing, Transmissometers, Slant range, Data compression, Airports (U)
IDENTIFIERS: AN/GMQ-10 (U)

A study has been made of the feasibility of using a laser backscatter system (lidar) to measure slant visibility at airports. This report summarizes the present status of lidar from a technical standpoint. Based largely on the results of experimental lidar field tests reported previously, the report isolates essential factors which bear on decisions regarding further lidar development. The following elements, upon which the success of an operational lidar visibility system will hinge, are discussed in detail: Detector and receiver dynamic range; Minimum and maximum range limits; Signal processing (instant vs time-average); Interpretation of data; Multiple scattering; Eye safety criteria. (U)

AD-A001 235 17/8 16/1
WYOMING UNIV LARAMIE DEPT OF MECHANICAL ENGINEERING

A Laser System for Determination of Rocket Attitude and Roll Rate. (U)

DESCRIPTIVE NOTE: Technical rept. 15 Nov 73-14 Jul 74,
JUL 74 96P Pell,Kynric M. ;Russell, Mark J. ;Nydahl,John E. ;Russell,William R.
;
REPT. NO. UWME-DR-4061051
CONTRACT: DAHC04-74-G-0063
MONITOR: ARO 12102.2-RTL

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: *Guided missile ranges, *Radar tracking, *Optical radar, Lasers, Tracking stations, Attitude indicators, Roll, Pitch(Inclination), Errors, Degrees of freedom, Computerized simulation, Computer programs (U)
IDENTIFIERS: Role rate, *Corner reflectors, Error analysis, Six degrees of freedom (U)

The use of ground based tracking laser transmitting and detecting stations and retroreflector equipped vehicles as a system to determine vehicle attitude and roll rate is investigated. Ground station location and vehicle dynamics are considered. The results show that the system represents a viable approach to test range instrumentation. (U)

AD-A000 909 17/5 20/5
AIL MELVILLE N Y

Chemical Ladar Investigation. (U)

DESCRIPTIVE NOTE: Final technical rept. Jan-Jul 74,
AUG 74 124P Chiou,W. C. ;Breitzer,D.
I. ;
REPT. NO. AIL-A629-F
CONTRACT: DAAH01-74-C-0321
PROJ: DA-7-X-362204
MONITOR: RK CR-75-13

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: *Optical radar, *Chemical lasers, Target detection, Heterodyning, Wave equations, Transmitter receivers, Signal to noise ratio, Infrared receivers, Doppler radar, Frequency, Optical equipment, Numerical analysis (U)
IDENTIFIERS: *Ladar(Laser Detection and Ranging.), Laser detection and ranging (U)

The applicability of the high-energy multiline chemical laser to a ladar (laser radar) system is considered. The chemical ladar system is inherently a frequency diversity radar system. For spectrally fluctuating targets the chemical ladar system can extend performance beyond the limit set by an equal power single-line ladar system. A receiver configuration suitable for the chemical ladar system is conceived, and the resolution and discrimination ability of the multiline ladar is considered. It is shown that the chemical ladar system can perform effective cross-range correlation measurements and doppler spread measurements of spectrally dependent objects. (U)

AD-A000 634 17/8 20/6
ROCK ISLAND ARSENAL ILL GENERAL THOMAS J RODMAN LAB

Design and Construction of a Coherent Optical Adaptive Techniques Array. (U)

DESCRIPTIVE NOTE: Final rept.,
AUG 74 32P Lavan,Michael J. ;
Cadwallender,William K. ;DeYoung,Tice F. ;

REPT. NO. RIA-R-TR-74-041
PROJ: DA-1-T-662612-D-459

UNCLASSIFIED REPORT

DESCRIPTORS: *Optical radar, *Phased arrays, Lasers, Self organizing systems, Control systems, Computerized simulation, Electronic equipment, Fabrication, Acoustooptics, Laser modulators, Crystal oscillators (U)
IDENTIFIERS: COAT(Coherent Optical Adaptive Techniques), Coherent Optical Adaptive Techniques, Performance evaluation, Atmospheric attenuation (U)

A Coherent Optical Adaptive Techniques array has been designed and constructed. This array will provide an experimental device to test innovations and developments required for integration of COAT systems with fieldable High Energy Laser (HEL) systems. (Author) (U)

AD- 923 606 17/8 4/2 20/5
STANFORD RESEARCH INST MENLO PARK CALIF

Use of Lidar in Support of Point Mugu Range Operations. (U)

DESCRIPTIVE NOTE: Final rept.,
SEP 67 85P Fernald,F. G. ;Oblanas,J. ;Ligda,M. G. H. ;Allen,R. W. ;Collis,R. T. H. ;
CONTRACT: Nonr-4471(00)
PROJ: SRI-5044

UNCLASSIFIED REPORT

DESCRIPTORS: (*Optical radar, *Stratus clouds), (*Carbon dioxide lasers, Stratus clouds), Visibility, Mathematical prediction, Clouds, Forming techniques, Temperature inversion, Slant range, Backscattering, Fog, Meteorological data, Density, Meteorological instruments, Ruby lasers, Cross polarization, Water vapor, Radiosondes, Wind, Polarization, Guided missile ranges, Particle size, Atmospheric physics (U)
IDENTIFIERS: Predetection, Spatial backscatter function, Meteorological laser system, Ice crystals, Lidar (U)

An experimental and theoretical study was made of ways in which lidar observations could aid in such operational meteorological problems at the Pacific Missile Range as the measurement of slant visibility and the prediction of the formation of stratus cloud. Techniques are presented for measuring the height of the atmospheric inversion and predicting the levels at which the stratus clouds will form. On two different occasions, experiments were conducted that did provide advanced warning of the onset of stratus even before they were visible to the unaided eye. Experiments were conducted to verify techniques developed for measuring slant visibility by application of lidar backscatter data. In addition, limited experiments indicated that the crosspolarized component on signals backscattered from ice crystals is measurably stronger, compared to that in the plane transmitted, than is the case with spherical scatterers such as water droplets. (U)

AD- 922 651 20/5 17/8 17/5 17/9
TRW SYSTEMS GROUP REDONDO BEACH CALIF

Laser Radar Technology. (U)

DESCRIPTIVE NOTE: Final rept. Jan-Aug 74,
SEP 74 90P Yano,K. T. ;Heflinger,L. O. ;Clark ,G. L. ;Kolpin,M. A. ;
REPT. NO. TRW-23897-6003-RU-00
CONTRACT: DAAH01-74-C-0339
MONITOR: RK CR-75-12

UNCLASSIFIED REPORT

DESCRIPTORS: (*Chemical lasers, Hydrogen fluoride), (*Optical radar, Light pulses), (*Infrared lasers, Deuterium compounds), (*Infrared detectors, Heterodyning), Molecular spectroscopy, Discharge tubes, Pulse generators, Interferometers, Line spectra, Infrared spectra, Carbon dioxide lasers, Sizes(Dimensions), Weight, Efficiency, Frequency stabilizers, Oscillators, Plasma medium, Dissociation, Helium, Sulfur compounds, Deuterium, Fluorides, Radar targets, Backscattering, Diffuse reflection, Refractive index, Ionization, Gain, Energy (U)
IDENTIFIERS: *Deuterium fluoride lasers, *Hydrogen fluoride lasers, *Chain reaction lasers, Middle infrared region, Sulfur hexafluoride, Local oscillators (U)

This report is a study made to assess the feasibility of using a pulsed chemical laser as a laser radar transmitter. The electrically-initiated pulsed chain-reaction chemical laser offers substantial improvement of performance over conventional electric CO2 lasers. This improved performance is in higher efficiencies and higher specific energies which tend to decrease the overall system's size and weight. The performance calculations of a pulsed chemical D2-F2 laser are described. These include computations dealing with the multiple-line output of the chemical laser, and also computations of performance for a laser constrained to operate on discrete lines. Short discussions on various aspects of laser operation are included that may have direct bearing on operation of the laser in a radar role. A study of heterodyning detection as it relates to a laser radar is also given. Experimentally, (U)

AD- 917 105 15/2 17/5 17/9
NAVAL WEAPONS LAB DAHLGREN VA

Preliminary Evaluation of LIDAR Techniques for Advance Warning of Biological Threats. (U)

DESCRIPTIVE NOTE: Technical rept.,
FEB 74 51P Hoye,Walter E. ;
REPT. NO. NWL-TR-3005

UNCLASSIFIED REPORT

DESCRIPTORS: (*Biological aerosols, Detection), (*Ultraviolet detectors, Biological aerosols), (*Optical radar, Biological aerosols), (*Mathematical models, Detection), Microorganisms, Bacterial aerosols, Fluorescence, Ultraviolet spectra, Light scattering, Raman spectra, Atmospheres, Visible spectra, Tryptophan, Chlorophylls, Proteins, Nucleic acids, Amino acids, Peptides, Escherichia coli, Algae, Mathematical prediction, Equations, Quantum efficiency, Optical properties (U)
IDENTIFIERS: *Light detection and ranging, LIDAR(Light detection and ranging) (U)

Equations have been developed to predict the capabilities of laser radar techniques for detection of airborne microorganisms. In order to discriminate threat microorganisms from normal atmospheric contents, optical interactions such as fluorescence and Raman scatter must be utilized. Selected optical properties of microorganisms, mostly bacteria, have been explored. Preliminary experimental results of the ultraviolet and visible optical density, the spectral fluorescence characteristics, and the fluorescence quantum efficiency of microorganisms are reported. The results are corrected for instrument biases and, in general, show characteristic nucleic acid and protein absorption in the ultraviolet while tryptophan and chlorophyll fluorescence are predominant. A preliminary value of 12 percent was obtained for the tryptophan quantum efficiency of Escherichia coli. The results are used in the LIDAR equations to predict that the fluorescence technique does have promise of detecting bacteria concentrations of 3 x 10 to the 6th power organisms/cubic meters at remote ranges of 1 km at night and 500 m in the day. (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOM07

AD- 915 878 4/1 17/9 20/5 17/5 7/4
TECHNOLOGY SERVICE CORP SANTA MONICA CALIF

Atmospheric Propagation in the Middle-Infrared and at 8-14 Micrometers. (U)

DESCRIPTIVE NOTE: Final rept.,
SEP 73 128P Stacey,J. ;Arnold,J. ;
REPT. NO. TSC-PD-B408-1
CONTRACT: DAAH01-73-C-1229

UNCLASSIFIED REPORT

DESCRIPTORS: (*Atmospheres, Light transmission), (*Optical radar, *Carbon dioxide lasers), (*Infrared detectors, Airborne), (*Molecular spectroscopy, Absorption spectra), Air to surface, Slant range, Far infrared radiation, Attenuation, Losses, Rain, Fog, Haze, Signal to noise ratio, Laser beams, Digital computers, Computer programs, Transparence, Band spectra, Carbon dioxide, Water vapor, Troposphere, Nitrogen oxides, Infrared pulses, Energy, Quantum efficiency (U)
IDENTIFIERS: *Middle infrared region, *Atmospheric propagation, Nitrous oxide (U)

This study considers the problems of propagation through the lower troposphere in the middle-infrared and in the 8 to 14 micrometer regions of the spectrum. The atmospheric constituents that scatter and absorb energy at these wavelengths are identified and the losses are calculated for several air-to-ground transmission paths. Examples of the atmospheric transmission losses are calculated for several passive sensor bandpasses and for a radar at 10.59 micrometers. In these examples, the atmospheric constituents that contribute to the total propagation loss over the sensor bandpass are individually identified and the accumulated losses are separately reported as a function of slant range. The performance for active and passive sensors is calculated and plotted for a host of weather conditions. Variations in rain rates, fog densities, and haze visibilities are introduced to demonstrate the relative degradation to the S/N for the sensor system. (U)

AD- 914 410 15/3.1 17/8 20/5 19/5
BOEING AEROSPACE CO SEATTLE WASH ARMY SYSTEMS DIV

Laser Observation of Fragmented Tank.
Volume 2. Appendix. (U)

DESCRIPTIVE NOTE: Final technical rept. May-Sep 73,
SEP 73 120P Briggs,J. D. ;
REPT. NO. D180-17619-2
CONTRACT: DAHC60-73-C-0088

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: See also Volume 1, AD-527 874L.

DESCRIPTORS: (*ANTIMISSILE DEFENSE SYSTEMS, *OPTICAL RADAR), (*LASERS, ANTIMISSILE DEFENSE SYSTEMS), (*OPTICAL TRACKING, BOOSTER ROCKETS), (*AIRCRAFT FIRE CONTROL SYSTEMS, *OPTICAL TARGET DESIGNATORS), VIDICONS, AIRBORNE, CLEAR AIR TURBULENCE, AERIAL TARGETS, FRAGMENTATION, SURFACE TO SURFACE MISSILES, AIRCRAFT TURRETS, LIQUID ROCKET FUELS, TARGET ACQUISITION, JET TRANSPORT PLANES, INTENSITY, COHERENT RADIATION, MISSION PROFILES, BORESIGHTING, GIMBALS (U)
IDENTIFIERS: LOFT(LASER OBSERVATION OF FRAGMENTED TANKS), LASER OBSERVATION OF FRAGMENTED TANKS, TARGET SIGNATURES, NC-135, C-135 AIRCRAFT, TITAN 2 MISSILES (U)

Contents: TITAN II Fragment Description; Daylight Tracking of Booster Fragments with Visible Imaging Sensors; State of Art Review - CO2 Laser Technology; Magnetics; Suspension Springs; Target Designation Study; Capability Summary For AEC Controlled NC-135 Aircraft; and Impact on Pointing and Tracking Assembly when Laser Radar Capability is Increased. (U)

AD- 913 768 17/8 17/5 20/5 20/6
ROCKWELL INTERNATIONAL CORP ANAHEIM CALIF ELECTRONICS RESEARCH DIV

Line Array Imaging Techniques. (U)

DESCRIPTIVE NOTE: Final rept.,
MAY 73 73P Kumagai,Tom T. ;
REPT. NO. C72-1013/501
CONTRACT: N00014-72-C-0504, ARPA Order-1806

UNCLASSIFIED REPORT

DESCRIPTORS: (*OPTICAL RADAR, MECHANICAL SCANNING), (*INFRARED TELESCOPES, MULTIPLE OPERATION), (*INFRARED DETECTORS, OPTICAL SCANNING), INFRARED IMAGES, BORESIGHTING, GAS LASERS, INTENSITY, INFRARED LASERS, CARBON DIOXIDE, POLARIZATION, WATER VAPOR, DIFFRACTION GRATINGS, ELECTROOPTICS, INFRARED PULSES, GALVANOMETERS, LIGHT TRANSMISSION, MIRRORS, OSCILLATION, SIGNAL-TO-NOISE RATIO, ROTATION, SPINNING(MOTION), RANGE(DISTANCE), PRISMS(OPTICS), DOPPLER EFFECT, PIEZOELECTRIC CRYSTALS, ALIGNMENT, ANGLE OF ARRIVAL, RESOLUTION, REFLECTIVITY, AIR, FOG, RAIN (U)
IDENTIFIERS: ACOUSTOOPTICS, BEAM SPLITTERS, BREWSTER ANGLE, BRAGG ANGLE, OPTICAL APERTURES (U)

This optical design study determined the utility of mechanically-scanned transmitter techniques for a laser radar designed for fine-grained target imaging and tracking. Beam combiner techniques were studied to permit the laser radar to share large diameter optics with a high-energy laser. Beam combiners are not currently available; thus, the recommended optical design is based upon a dual aperture system. A survey of scanning techniques was performed to determine the most optimum scanner for a high efficiency system with 100 x 100 diffraction-limited resolution elements operating at 100 frames per second. Upon completion of the survey, concentrated effort was placed on the application of a multifaceted rotating scanner and a torsional oscillating scanner. The study included investigations in the following areas: Scanner distortion, offset angle correction, optical cross-talk, signal-to-noise, Doppler bandwidth, range accuracy requirements, optical design consideration, and numerous other related areas. (U)

AD- 912 391 17/8 19/1 20/5
RAYTHEON CO BEDFORD MASS MISSILE SYSTEMS DIV

LAW Laser Rangefinder Design Study and Demonstration Model. (U)

DESCRIPTIVE NOTE: Final rept.
AUG 73 137P
REPT. NO. BR-7628
CONTRACT: DAAA25-73-C-0173

UNCLASSIFIED REPORT

DESCRIPTORS: (*RANGE FINDING, OPTICAL RADAR), (*LASERS, RANGE FINDING), FEASIBILITY STUDIES, ANTITANK AMMUNITION, ROCKETS, SURFACE TO SURFACE, INFRARED DETECTORS, FIELD EFFECT TRANSISTORS, HAZARDS, EYE, RANGE(DISTANCE), SIGNAL-TO-NOISE RATIO, RANGE GATING, PLASTIC LENSES, SILICON, INFRARED PULSES, PHOTODIODES, GALLIUM ARSENIDES, SEMICONDUCTOR DIODES (U)
IDENTIFIERS: FRESNEL LENSES, LAW(LIGHT ANTITANK WEAPON), *LIGHT ANTITANK WEAPONS (U)

Theoretical considerations, undertaken at the commencement of this study, have indicated the feasibility of a rangefinding system which utilizes a relatively low power GaAs laser and yields ranging capability in excess of 500 meters. The initial aspects of the study were concerned with signal processing techniques which would afford this ranging capability while utilizing optical and electric components commensurate with a small, portable system. The signal processing method chosen as the result of this study involves received pulse integration yielding a signal-to-noise ratio enhancement proportional to the square root of the number of pulses integrated. The manner in which various optical and electronic parameters affect the ranging capability of the system have also been determined. This has enabled trade-offs among these parameters to be realized. A specific set of these parameters was used as the basis of a demonstration rangefinder. The demonstration rangefinder was designed, fabricated and field tested. (U)

AD- 912 237 4/2 20/5 19/5
NAVAL WEAPONS LAB DAHLGREN VA

A Laser Meteorological System Study. (U)

DESCRIPTIVE NOTE: Technical rept.,
SEP 72 34P Ely,Richard I. ;
REPT. NO. NWL-TR-2839

UNCLASSIFIED REPORT

DESCRIPTORS: (*LASERS, *METEOROLOGICAL INSTRUMENTS), (*OPTICAL RADAR, METEOROLOGICAL INSTRUMENTS), (*DOPPLER SYSTEMS, WIND), RANGE TABLES, DENSITOMETERS, DOPPLER EFFECT, HUMIDITY, ATMOSPHERIC TEMPERATURE, MEASUREMENT, INSTRUMENTATION, AIR, RAYLEIGH SCATTERING, FREQUENCY SHIFT, TELESCOPES, INTERFEROMETERS, TUNING DEVICES, THERMOMETERS, COSTS, ANEMOMETERS, MOLECULAR SPECTROSCOPY, RAMAN SPECTROSCOPY, FLASH LAMPS, DYES, GAIN, CONCENTRATION(CHEMISTRY), ETHANOLS, ORGANIC SOLVENTS, COLORS (U)
IDENTIFIERS: DYE LASERS, LIQUID LASERS, MIE SCATTERING, RESONANCE RADIATION, RHODAMINE 6G DYE (U)

A study was conducted to determine the feasibility of a meteorological system using a lidar (laser radar) for the remote and rapid measurement of atmospheric parameters. In particular, the feasibility of measuring air density and wind velocity was investigated. It was determined that air density could be measured best by physically measuring the air temperature profile and calculating the density from it. A coaxial laser Doppler system was chosen to measure the two parameters. The broadening of the Rayleigh line determined air temperature and the shift from laser frequency of the particulate scattered line determined wind velocity. The system to be built used a 10-inch, f/13 Schmidt Cassegrain telescope, a single-frequency dye laser, and a tuneable Fabry-Perot interferometer. Single-frequency operation of the dye laser was not achieved so the system was not field tested. The ability of a spherical Fabry-Perot interferometer to measure Doppler shifts was tested in the laboratory. Frequency shifts as low as 1.5 MHz could be detected by an interferometer which had a bandwidth of only 20 MHz. The gains of several flashlamp pumped dyes were measured at 632.8nm. (U)

AD- 912 145 20/5 15/3.1 17/8
BOEING AEROSPACE CO SEATTLE WASH ARMY SYSTEMS DIV

Laser Applications System Study. Volume
V. Appendix. (U)

DESCRIPTIVE NOTE: Final rept. Jun 72-Jul 73,
JUL 73 290P Hovnanian,V. P. ;
REPT. NO. D180-17537-5
CONTRACT: DAAH01-72-C-1144

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: See also Volume 1, AD-526 592.

DESCRIPTORS: (*LASERS, *ANTIMISSILE DEFENSE SYSTEMS), OPTICAL RADAR, TARGET DISCRIMINATION, ENERGY, SCINTILLATION, DOPPLER EFFECT, RADAR CROSS SECTIONS, POWER, SPINNING(MOTION), TUMBLING, TARGETS, BALLOONS, OPTICAL TRACKING, OPTICAL TARGET DESIGNATORS, INFRARED RADIATION, BACKSCATTERING, SIMULATION, PARTICLES, FREQUENCY MODULATION, REENTRY VEHICLES, DECOYS, FREQUENCY SHIFT (U)
IDENTIFIERS: ASPECT ANGLE, BULK FILTERING, DEMODULATION, HETERODYNING, LASERS, OPTICAL RADAR, SPREAD SPECTRUM, TANK FRAGMENTS, TARGET SIGNATURES (U)

Contents: Introduction and Summary; Effect of High Energy Particles on the Performance of a Laser Radar's Optical Heterodyne Receiver; The Effect of Target Scintillation Due to Rotation on the Performance of an FM Laser Radar; Laser Radar Doppler Cross-Section for a Spinning Cone; Laser Radar Balloon Discrimination with a Tumbling Target; Double Aperture Laser Radar Target Spin Rate Determination; Rotation Target Doppler Spread and Its Effect on Heterodyne Detection Laser Radar Performance; Simulation of Laser Discrimination of Objects, with Arbitrary Orientations; Analysis of Speckle Correlation Through Spatial Coherence; Laser Waveform Requirements; Discrimination Power Requirements - Probe Mission and Laser Radar Cross-Section Simulation Results. (U)

AD- 912 144 20/5 15/3.1 17/8
BOEING AEROSPACE CO SEATTLE WASH ARMY SYSTEMS DIV

Laser Applications System Study. Volume
IV. Laser Radar Subsystems. (U)

DESCRIPTIVE NOTE: Final rept. Jun 72-Jul 73,
JUL 73 181P Hovnanian,V. P. ;
REPT. NO. D180-17537-4
CONTRACT: DAAH01-72-C-1144

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: See also Volume 5, AD-912 145L.

DESCRIPTORS: (*LASERS, *ANTIMISSILE DEFENSE SYSTEMS), (*OPTICAL RADAR, ANTIMISSILE DEFENSE SYSTEMS), TARGET DISCRIMINATION, GAS LASERS, CARBON DIOXIDE, SIGNAL-TO-NOISE RATIO, ALGORITHMS, POWER, DOPPLER EFFECT, ELECTROOPTICS, MODULATORS, OPTICAL TRACKING, ENERGY, OPTICAL TARGET DESIGNATORS, REENTRY VEHICLES (U)
IDENTIFIERS: BULK FILTERING, *LASERS, *OPTICAL RADAR, INFRARED RADIATION, LONG WAVELENGTHS, MICROWAVE EQUIPMENT, RADAR, SEMIACTIVE GUIDANCE, SIGNAL PROCESSING, TIME CONSTANTS (U)

This volume presents data on the laser radar subsystems. This study concentrated on the acquisition and discrimination performance of lasers which are the two functions that are of significance in sizing lasers. Search capabilities of lasers are limited because of the concentration of energy in a fine beam. Therefore, other acquisition sensors are postulated to handover data to the laser; namely, LWIR and microwave radars. The accuracy with which these sensors can handover data to the laser varies between 0.1 mrad for LWIR systems up to 1.0 mrad for microwave radars. The laser acquisition task we have been concerned with thus involves searching the limited field of view designated to the laser by the other sensors. (U)

AD- 906 781   17/8   19/1
FLORIDA UNIV GAINESVILLE DEPT OF AEROSPACE ENGINEERING

Performance of Optical Proximity Fuzes in Degraded Atmospheres. (U)

DESCRIPTIVE NOTE: Final rept., Apr 71-Aug 72,
SEP 72   37P   Anderson,R. C. ;McRae,T. G. ;
CONTRACT: F08635-71-C-0132
PROJ: AF-2508
TASK: 250802
MONITOR: AFATL   TR-72-180

UNCLASSIFIED REPORT

DESCRIPTORS: (*PROXIMITY FUZES, OPTICAL EQUIPMENT), (*LASERS, OPTICAL TRACKING), (*OPTICAL RADAR, BACKSCATTERING), DEGRADATION, GALLIUM ARSENIDES, AEROSOLS, ATMOSPHERES, PHOTODIODES, OPTICAL SCANNING, AVALANCHE DIODES, PARTICLE SIZE, CLOUDS, FOG, RANGE FINDING, REFLECTIVITY, TARGETS, MOBILE (U)
IDENTIFIERS: LIDAR(LIGHT DETECTION AND RANGING), LIGHT DETECTION AND RANGING, *OPTICAL PROXIMITY FUZES, SHORT RANGE LIDAR, SRL(SHORT RANGE LIDAR) (U)

The primary purpose of this program was to investigate reflected signals from atmospheric aerosols in order to ascertain their strength and to determine whether or not they were distinguishable from signals reflected from solid targets. The range degradation of the system due to the presence of various aerosol size distributions was also to be determined. Tests conducted during the program included system stability, receiver linearity, and target reflectivities. In addition, transmission, aerosol, and backscatter measurements were taken. Results show that, for the system tested, backscatter from natural aerosols should be only a marginal problem. However, for a system where the field of view is large compared to size of the target, detectable returns from aerosols might be expected, so that each new configuration should be examined for a possible backscattered signal. (Author) (U)

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DDC REPORT BIBLIOGRAPHY   SEARCH CONTROL NO. ZOMO7

AD- 905 202   20/5   17/8   17/5
HUGHES RESEARCH LABS MALIBU CALIF

Laser Beam Steering. (U)

DESCRIPTIVE NOTE: Final rept. 14 Jun 71-14 Jun 72,
OCT 72   89P   Lotspeich,J. F. ;Wauk,M. T. ;
CONTRACT: F33615-71-C-1736
PROJ: AF-6100
TASK: 610004
MONITOR: AFAL   TR-72-308

UNCLASSIFIED REPORT

DESCRIPTORS: (*GAS LASERS, ELECTRONIC SCANNERS), (*OPTICAL RADAR, ELECTRONIC SCANNERS), (*INFRARED LASERS, CARBON DIOXIDE), STEERING, ACOUSTICS, DIFFRACTION, GERMANIUM, POLARIZATION, FREQUENCY MODULATION, PIEZOELECTRIC TRANSDUCERS, ULTRASONIC WELDING, ABSORPTION, REFLECTION, BARIUM, BONDING, SODIUM, NIOBIUM, LIQUID COOLED, OPTICAL SCANNING, HEATING, ELECTROOPTICS, DESIGN, PHASED ARRAYS, ACOUSTIC PROPERTIES, THERMAL PROPERTIES, POWER (U)
IDENTIFIERS: ACOUSTOOPTICS, *BEAM STEERING, BRAGG DIFFRACTION, LASERS, OPTICAL RADAR (U)

An electronic beam scanner for CO2 lasers was designed and constructed. Specific requirements to be met were: three degree scan range, 100 resolvable beam positions, 6000 Hz raster scan in one dimension, and a capability for 100 W of 10.6 micrometer output. The device employs acousto-optic Bragg diffraction using germanium with a longitudinal acoustic wave and laser beam polarization in the crystallographic <111> direction. Sawtooth FM over a 27 MHz band centered near 100 MHz is used to provide the scan mechanism. A single small Ba2NaNB5O15 transducer provides sufficient acoustic beam divergence to yield a 3 deg. scan capability with a 1.4 dB falloff in output beam power at the scan limits. Direct-contact water cooling of the Ge crystal is provided to prevent thermal runaway. Cylindrical, reflective, telescopic optics are used for beam conditioning and recollimation. Computer calculations provided impedance characteristics and frequency response curves for general transducer design. Transducer bonding was done ultrasonically using thin metal films of Ag, Au, and Ag-In. (U)

AD- 901 213 20/5 17/8
MASSACHUSETTS INST OF TECH LEXINGTON LINCOLN LAB

Optics Research: 2. (U)

DESCRIPTIVE NOTE: Semiannual rept. 1 Jul-31 Dec 71,
71 93P Kingston,Robert H. ;
CONTRACT: F19628-70-C-0230, ARPA Order-600
MONITOR: ESD TR-72-31

UNCLASSIFIED REPORT

DESCRIPTORS: (*LASERS, *OPTICAL RADAR), (*GAS LASERS, *INFRARED LASERS), CARBON DIOXIDE, CARBON MONOXIDE, FOG, PLASMA MEDIUM, ELECTRON BEAMS, INTERACTIONS, DAMAGE, RADIATION EFFECTS, HIGH SPEED PHOTOGRAPHY, ELECTROSTATICS, FOCUSING, AIR, INSTRUMENTATION, SEMICONDUCTOR DEVICES, FREQUENCY CONVERTERS, INFRARED IMAGES, LIGHT TRANSMISSION, PROPAGATION, AIR POLLUTION, INFRARED TRACKING, INFRARED PULSES, AIRBORNE, TUNING DEVICES (U)
IDENTIFIERS: CHEMICAL LASERS, CONTINUOUS WAVES, HOLE BORING, INJECTION LASERS, LASER RADAR IMAGES, LASERS, OPTICAL RADAR, RETROREFLECTORS, THERMAL BLOOMING, TUNABLE LASERS (U)

This report covers work of the Optics Division at Lincoln Laboratory for the period 1 July through 31 December 1971. The topics covered are laser technology and propagation, optical measurements and instrumentation, and laser radar and tracking. Additional information on the optics program may be found in the semiannual technical summary reports to the Advanced Research Projects Agency. (Author) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOM07

AD- 889 028 17/8 4/1 13/2
DESERET TEST CENTER FORT DOUGLAS UTAH

LIDAR-Tracer Atmospheric Diffusion Measurement System. (U)

DESCRIPTIVE NOTE: Technical note,
AUG 71 22P Ross,Richard A. ;
REPT. NO. DTC-TN-72-602
PROJ: RDT/E-1-T-062111-A-128, USATECOM-5-CO-403-000-031

UNCLASSIFIED REPORT

DESCRIPTORS: (*OPTICAL RADAR, LASERS), (*LIGHT TRANSMISSION, ATMOSPHERES), (*AIR POLLUTION, MEASUREMENT), COHERENT RADIATION, SCATTERING, RAMAN SPECTROSCOPY, TRACER STUDIES (U)
IDENTIFIERS: ATMOSPHERES, ATTENUATION, *ATMOSPHERIC SCATTERING, *LASERS, *OPTICAL RADAR (U)

Development of the Raman LIDAR (Laser Radar) system has realized marked progress in recent months. It will provide a unique method for determining the composition and concentration of atmospheric constituents as small as gas molecules. Thus, this system will not only provide a method for monitoring the status of the atmosphere but also provide instantaneous pprtrayals of changes of the density of a portion of a tracer cloud, as well as identify the content of the cloud. This is most easily accomplished by utilizing the phenomenon of Raman scattering in conjunction with an appropriate tracer cloud. A Raman LIDAR system would allow an indifect measurement of turbulent diffusion processes, concentration profiles, and composition identification that would be orders of magnitude better than the existing standard field sampler techniques. Employing information from such a system would allow the computation of such things as downwind hazard prediction with marked improvement in the precision because of the higher grade data which would incorporate continuous real time sampling from a sensor located at a site remote from the tracer cloud. (Author) (U)

AD- 889 027 17/8 17/5 4/1
DESERET TEST CENTER FORT DOUGLAS UTAH

Laser Radar Technology. (U)

DESCRIPTIVE NOTE: Technical note,
OCT 71 33P Pekny,William M. ;
REPT. NO. DTC-TN-72-603
PROJ: RDT/E-1-T-062111-A-128, USATECOM-5-CO-403-000-038

UNCLASSIFIED REPORT

DESCRIPTORS: (*OPTICAL RADAR, LASERS), (*LIGHT TRANSMISSION, ATMOSPHERES), ATMOSPHERE MODELS, SCATTERING, PARTIAL DIFFERENTIAL EQUATIONS, COHERENT RADIATION, AEROSOLS (U)
IDENTIFIERS: ATMOSPHERES, ATTENUATION, *LASERS, *OPTICAL RADAR (U)

Laser Radar (LIDAR) is a transceiver system which measures the amount of light returned to a receiver due to backscattering of the transmitted signal from the intervening media (gases, droplets, and aerosols). Besides providing a ranging capability, LIDAR is important tool for the monitoring of atmospheric diffusion processes. The usefulness of such a system is most evident in light of the fact that backscattered energy which is detectable to the receiver provides an observer with a multitude of information about the small volume of atmosphere which caused the scattering. Since several highly variable atmospheric parameters define the amount and manner of light scattering, hence the amount of energy returned, numerical models of the atmosphere are constructed which account for the fluctuations of the returned signal, in terms of the controlling atmospheric parameters. Thus the amplitude of the signal returned is an anomalous measurement of the state of the atmospheric volume which caused the scattering. In order to relate the atmospheric variables to the LIDAR system variables, an exact equation which describes the motion and interaction of the signal beam with the atmosphere must be developed and modeled. A discussion of the implications and significance of the scattering equations and parametric relationships is undertaken, in an attempt to isolate concentration of the atmospheric volume as a measurable quantity in terms of system variables. (Author) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOM07

AD- 875 199 20/6 17/8
OWENS-ILLINOIS INC PITTSBURGH PA FECKER SYSTEMS DIV

Design Study for a Coelostat Tracking Mount. (U)

DESCRIPTIVE NOTE: Final technical rept.,
AUG 70 352P Bouvier,A. ;Riggenbach,H. ; Carballal,J. ;Wassick,J. ;Myers,R. ;
REPT. NO. F(5)-318-047-022-1431
CONTRACT: F30602-69-C-0323
PROJ: AF-6527
TASK: 652701
MONITOR: RADC TR-70-25

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: Includes Addendum.

DESCRIPTORS: (*OPTICAL EQUIPMENT, DESIGN), (*OPTICAL RADAR, OPTICAL EQUIPMENT), CONFIGURATION, GAS LASERS, DRIVES, SERVOMECHANISMS, TRACKING, GAS BEARINGS, MIRRORS, ALIGNMENT, CALIBRATION, ELECTRONIC EQUIPMENT, DIGITAL COMPUTERS, PROTECTIVE COVERINGS, RADOMES, SUPPORTS (U)
IDENTIFIERS: OPDAR TRACKING MOUNTS (U)

This report describes a study that investigated design concepts for a coelostat tracking mount for use as part of a CO2 laser tracking system. In this study design problems associated with the development of the mount were considered, design tradeoffs, optimized for performance with the constraints of manufacturability, were made, and requirements for major components and peripheral equipment were specified. The recommenced configuration is a two-axis mount with a 40-inch clear aperture, utilizing air bearings and a direct drive system with associated servo electronics for smooth tracking capability. (Author) (U)

AD- 871 751 17/8
ARMY MISSILE COMMAND REDSTONE ARSENAL ALA PHYSICAL SCIENCES LAB

Target Interference Effects on Optical Radar. (U)

DESCRIPTIVE NOTE: Technical rept.,
MAY 70 26P Emmons,G. A. ;Otto,W. F. ;
REPT. NO. RR-TR-70-7
PROJ: DA-7-X-263304-D-215

UNCLASSIFIED REPORT

DESCRIPTORS: (*OPTICAL RADAR, DETECTION), ELECTROMAGNETIC WAVE REFLECTIONS, TARGETS, DIFFRACTION, SIGNALS, DOPPLER EFFECT, STATISTICAL FUNCTIONS, POLARIZATION (U)

The report presents considerations of the effects of diffusely reflected signals on the performance of optical radars. If the rotation rate of a target is determined, an approximate measurement of its length, transverse to its direction of rotation, can be made. This can be accomplished by relating either the spatial autocorrelation function of the signal or the bandwidth of the Doppler shifted signal to the geometry. Some measure of target surface character can be obtained by determining the depolarization of the reflected signal. The random phase variations in the reflected signal confuse the Doppler velocity readout and decrease the velocity resolution. Hence, target patterns impose limitations on the accuracy of velocity measurements. The effect of target patterns on the probability of detection has been considered from the view of minimizing average power requirements. It was found that for minimum average power the signal should be divided into n pulses where n is a function of the probability of detection. (author) (U)

AD- 871 622 17/5
AIL DEER PARK N Y

Broadband Optical Receiver for 10.6 Microns. (U)

DESCRIPTIVE NOTE: Final technical rept. Feb-Nov 69,
MAY 70 29P Arams,F. ;Chiou,W. ; Flattau,T. ;Peyton,B. ;
REPT. NO. AIL-8216-1
CONTRACT: F30602-69-C-0216
PROJ: AF-6527
TASK: 652702
MONITOR: RADC TR-70-77

UNCLASSIFIED REPORT

DESCRIPTORS: (*INFRARED RECEIVERS, BROADBAND), (*OPTICAL RADAR, INFRARED RECEIVERS), DOPPLER SYSTEMS, TRACKING, GERMANIUM, DEMODULATORS, AUTOMATIC GAIN CONTROL, AUTOMATIC FREQUENCY CONTROL (U)

A packaged infrared 10.6-micron heterodyne receiver was developed for radar application. It combines sensitivity approaching the quantum-noise limit with gigahertz IF bandwidth. Signal processing electronics was also provided for search and acquisition of the doppler-shifted radar return signal, and other functions. The receiver has as its principal components a cryogenically cooled Ge:Cu infrared mixer element, and associated broadband IF preamplifier, IF and signal processing electronics, and peripheral monitor and control electronics. The receiver is suitably packaged for operational use in a 10.6-micron pulsed radar system. Design considerations and measured receiver characteristics are presented. Receiver noise properties for IF frequencies up to 1200 MHz and mixer noise characteristics were measured. The measured noise equivalent power was 8.1 x 10 to the minus 20th power w/Hz at 1.4 kHz, less than 1.5 x 10 to the minus 19th power w/Hz from 10 to 800 MHz, and less than 2.25 x 10 to the minus 19th power w/Hz up to 1200 MHz. (Author) (U)

AD- 871 607 17/5
ROME AIR DEVELOPMENT CENTER GRIFFISS AFB N Y

Doppler Measurements from Specular and Diffuse Targets, in Rotational and Translational Motion, Using 0.6 and 10.6 Microns Radiation. (U)

DESCRIPTIVE NOTE: Technical rept.,
MAY 70 43P Demma,Fred J. ;Michels, James H. ;
REPT. NO. RADC-TR-70-83
PROJ: AF-6527
TASK: 652701

UNCLASSIFIED REPORT

DESCRIPTORS: (*OPTICAL RADAR, INFRARED RADIATION), GAS LASERS, DOPPLER SYSTEMS, DOPPLER EFFECT, TARGETS (U)
IDENTIFIERS: CARBON DIOXIDE LASERS, HELIUM NEON LASERS (U)

The report presents the results of an investigation into the doppler shifted returns from both translating and rotating specular and diffuse targets at 0.6 and 10.6 microns. The doppler information was recovered through heterodyne techniques which are outlined in detail as to experimental configuration and procedure. The resulting agreement between experimental data and analytical predictions was quite substantial. (Author) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOMO7

AD- 868 280 17/5
AIL DEER PARK N Y

Advanced Capability Infrared Receiver System. (U)

DESCRIPTIVE NOTE: Final rept. 15 Mar 68-15 Dec 69,
MAR 70 81P Pace,F. ;Lange,R. ;Arams, F. ;Peyton,B. ;Sard,E. ;
REPT. NO. AIL-3481-F
CONTRACT: N00014-68-C-0273, ARPA Order-306

UNCLASSIFIED REPORT

DESCRIPTORS: (*OPTICAL RADAR, *INFRARED RECEIVERS), ANTENNA ARRAYS, GAS LASERS, MIXERS(ELECTRONICS), PHOTOELECTRIC MATERIALS, MICROWAVE EQUIPMENT (U)
IDENTIFIERS: DEFENDER PROJECT (U)

The program has demonstrated the following technological elements. A structure to support a 3 x 3 configuration of high performance 10.6 micrometer mixer elements. An array of microlenses that generate receiving antenna beams in registration and crossing each other at a point 3 dB below their peak responses. A mixer-preamplifier combination with measured NEP values of better than 2 x 10 to the -19th power watts/Hz from 10 MHz to 1500 MHz. A microstrip cabling technique to handle the microwave IF signals detected by the infrared mixers. Adequate thermal conductivity in the array structure to extract the heat dissipated by the local oscillator beam and dc bias current. At least 30 dB of electrical isolation at 1500 MHz between adjacent cooled mixer elements. (Author) (U)

AD- 867 780 17/5
AUTONETICS ANAHEIM CALIF

10.6 Micron Optical Scanner. (U)

DESCRIPTIVE NOTE: Final rept. 20 May 69-19 Feb 70,
MAR 70 51P Treuthart,R. L. ;
REPT. NO. C70-231/501
CONTRACT: F30602-69-C-0136, ARPA Order-1279
MONITOR: RADC TR-70-48

UNCLASSIFIED REPORT

DESCRIPTORS: (*OPTICAL RADAR, *OPTICAL SCANNING), MIRRORS, TORQUE, OPTICAL TRACKING, FEASIBILITY STUDIES (U)

A ballistic optical scanner stopped and reversed by a current impulse at each extreme of scan motion, and accomplishing each direction of scan motion via momentum from the drive impulses has been shown to be a feasible means of achieving equal observation times per scan resolution element. Operation from 0 to + or - 3/4 deg mirror angle from 2 to 10 Hz has been shown to be feasible. Operation through this angle from 0 to 2 Hz in a servo mode, with the scanner displacement slaved to a triangular (or other) voltage waveform has also been shown feasible. This scanner, of 20 cm clear aperture at 45 deg incidence, has a versatility of control enabling a ballistic search mode to be stopped anywhere within one resolution element of scan (1/2 mrad mirror angle), where the position may be locked, or where target tracking may then be accomplished by the servo mode of control. The use of two independent mirrors will permit a raster scan having a 3 deg by 3 deg field angle. (Author) (U)

AD- 864 683 20/5 17/5
ROME AIR DEVELOPMENT CENTER GRIFFISS AFB N Y

High Average Power Laser Amplifier Chain Techniques. (U)

DESCRIPTIVE NOTE: Final technical rept.,
JAN 70 31P Rehm,Frank J. ;Demma,Fred J. ;
REPT. NO. RADC-TR-69-463
PROJ: AF-6527, DA-65-1

UNCLASSIFIED REPORT

DESCRIPTORS: (*OPTICAL RADAR, *LASERS), LIGHT PULSES, GLASS, NEODYMIUM, GAIN, AMPLIFIERS (U)
IDENTIFIERS: NEODYMIUM GLASS LASERS (U)

The report describes the results obtained in the development of a high average power optical radar transmitter operating at 1.06 microns employing a master oscillator-power amplifier approach. The master oscillator was a mode controlled, water-cooled, pulsed device employing glass:Nd as the laser media. The amplifiers were water-cooled and operated under pulsed conditions and also used glass:Nd as the laser media. This approach yielded average powers of approximately 10 watts, i.e., 10 joules per pulse at a repetition rate of 1 pulse per second. This was accomplished without any degradation in the transverse mode characteristics of the oscillator signal. Based on these results, it is estimated that pulse energies of 50 joules could be readily achieved at 15 pulses per second, thereby leading to average powers of approximately 750 watts. (Author) (U)

AD- 857 302 4/1 17/8 20/5
NEW YORK UNIV BRONX GEOPHYSICAL SCIENCES LAB

Optical Sounding V. (U)

DESCRIPTIVE NOTE: Final rept. 1 Apr 68-30 Mar 69,
AUG 69 87P Bradley,James T. ;Schotland,
R. M. ;
REPT. NO. GSL-TR-69-5
CONTRACT: DAAB07-68-C-0276
PROJ: DA-1-T-061102-B-53-A
TASK: 1-T-061102-B-53-A-19
MONITOR: ECOM 0276-F

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: See also AD-838 389.

DESCRIPTORS: (*ATMOSPHERIC SOUNDING, *OPTICAL RADAR), (*WATER VAPOR, ATMOSPHERES), (*LASERS, OPTICAL RADAR), SPECTROMETERS, LINE SPECTRA, LIGHT PULSES, ABSORPTION(U)

A high resolution spectroscopic study of the 6943.8A water vapor line in the telluric spectrum has been undertaken. Data was examined using a scanning slit photometer located at the exit plane of a ten meter Czerny-Turner spectrometer. An analysis has been made of the errors introduced into the line parameters due to the physical slit widths and the speed of the scanning system. It is shown that the resultant telluric line can be approximated by an equivalent Lorentz line. At least squares program is used to evaluate the line strength and half width of the equivalent Lorentz line. Some observed telluric spectra are presented. A calculation is presented of the overlap beam area of a laser radar in which the optical axis of the transmitter and receiver beams are parallel but separated in space. Results of the calculation are given in the form of graphs involving the ratio of overlap area to that of the transmitted radar pulse as a function of range normalized by transmitter-receiver spacing. Calculations were performed for combinations of transmitter and receiving beam widths of 0.001, 0.003, 0.005, and 0.007 radians. (Author) (U)

AD- 855 313 17/5 17/8 20/5
STANFORD RESEARCH INST MENLO PARK CALIF

Tactical Considerations of Atmospheric Effects on Laser Propagation. (U)

DESCRIPTIVE NOTE: Final rept. 13 Jan 68-28 Apr 69 on Phase 3,
APR 69 119P Allen,Robert J. ;Uthe,
Edward E. ;
CONTRACT: N00019-68-C-0201
PROJ: SRI-7165

UNCLASSIFIED REPORT

DESCRIPTORS: (*OPTICAL RADAR, LASERS), (*LASERS, LIGHT TRANSMISSION), (*LIGHT TRANSMISSION, ATMOSPHERES), (*OPTICAL TARGET DESIGNATORS, LASERS), ILLUMINATION, INFRARED RADIATION, VISIBILITY, SCATTERING, METEOROLOGICAL PHENOMENA (U)
IDENTIFIERS: MIE SCATTERING (U)

The pertinent findings of a three-year study of the effects of the atmosphere on laser propagation are presented, primarily in connection with the Remote Target Designator and Target Illumination System. In addition to data in support of the basic design of tactical weapon systems, this study has also produced information concerning available methods and techniques with which to determine the probability of completing a mission successfully by inferring atmospheric transmission properties at the 1.06-micrometer laser wavelength from on-the-spot observations. It is shown that this is best implemented by adding lidar (laser radar) capabilities to the target designator/illuminator. This addition would also permit atmospheric transmission to be determined at night, would eliminate human error and the need for specialized training, and would provide a more precise determination of atmospheric transmission in space and time coordinates. The nature of Mie scattering as investigated using Fourier techniques is reported. These studies have provided a better insight into how atmospheric scattering properties can be generally described if it is shown that empirical backscatter-extinction relations may exist for highly absorbing Mie particles, of for non-Mie particles regardless of the particle-size distribution. (Author) (U)

AD- 848 896   17/8
NAVAL AIR DEVELOPMENT CENTER JOHNSVILLE PA AERO-
ELECTRONIC TECHNOLOGY DEPT

A Parametric Investigation of a 10.6 Micron
Pulsed Laser Radar, (U)

DEC 68   34P   Petri,K. J. ;
REPT. NO. NADC-AE-6833

UNCLASSIFIED REPORT

DESCRIPTORS: (*OPTICAL RADAR, *GAS LASERS), INFRARED PULSES, REVIEWS, ATTENUATION, DEMODULATION, CARBON DIOXIDE, NITROGEN, HELIUM (U)

The report proposes a high resolution pulsed optical radar using the recently developed, high power, CO2-N2-He gas laser as the optical transmitter. This laser operates at 10.6 microns, a wavelength corresponding to one of the best atmospheric windows. In addition, the Co2-N2-He laser operates at high efficiencies never before achieved in the gas laser field. The theory and operating characteristics of this laser are described and compared with existing lasers to determine its advantages as an optical transmitter. Atmospheric attenuation and detection techniques at this wavelength are evaluated. Applicable radar range equations are applied. (Author) (U)

AD- 847 710   17/8   15/3.1
ARMY MISSILE COMMAND REDSTONE ARSENAL ALA ADVANCED
SENSORS LAB

Laser Ranging System Simulation, (U)

DEC 68   90P   Woods,Hyram G. ;Harbor,
Royce D. ;
REPT. NO. RE-TR-68-19
PROJ: DA-1-X-242104-D-226

UNCLASSIFIED REPORT

DESCRIPTORS: (*GUIDED MISSILE TRACKING SYSTEMS, OPTICAL TRACKING), (*OPTICAL TRACKING, LASERS), OPTICAL RADAR, OPTICAL EQUIPMENT, SIMULATION, RANGE FINDING, ADAPTIVE SYSTEMS, TRAJECTORIES, PREDICTIONS, NUMERICAL ANALYSIS, THREAT EVALUATION, DIGITAL SYSTEMS, ANTIMISSILE DEFENSE SYSTEMS, ANTIAIRCRAFT DEFENSE SYSTEMS (U)

This laser tracker study is a sampled-data system simulation of a selected Army L-19 type of threat, prediction function, and NIKE-AJAX servo mount in the form of digital programs that can be processed separately or simultaneously to give in a real-time sense the response of the system to the threat. The study leads toward system response to an adaptive laser firing rate and to an adaptive laser beam. System accuracies for several laser repetition rates are illustrated for acquisition and the flyby trajectory. (Author) (U)

AD- 847 001 17/9 20/6
AIRBORNE INSTRUMENTS LAB DEER PARK N Y

Advanced Capability Infrared Receiver System. (U)

DESCRIPTIVE NOTE: Semiannual progress rept. no. 1, 15 Mar-15 Sep 68.
OCT 68 79P Pace,F. ;Arams,F. ;Lange, R. ;Peyton,B. ;Sard,E. ;
REPT. NO. AIL-3481-I-1
CONTRACT: N00014-68-C-0273, ARPA Order-306

UNCLASSIFIED REPORT

DESCRIPTORS: (*OPTICAL RADAR, GAS LASERS), (*INFRARED RECEIVERS, COHERENT RADIATION), ANTENNA ARRAYS, ANTENNA RADIATION PATTERNS, INFRARED PHOTOCONDUCTORS, INFRARED PHOTOELECTRIC CELLS, CRYSTAL MIXERS, INFRARED EQUIPMENT, INTERMEDIATE FREQUENCY AMPLIFIERS, GAS LASERS (U)
IDENTIFIERS: *CARBON DIOXIDE LASERS (U)

A report is made on a program to demonstrate the feasibility of a 10.6-micron coherent receiver array with 1.5-GHz IF bandwidth, 3 X 3 elements with -3 db antenna-beam crossovers, and near quantum-noise limited sensitivity. The two primary areas of investigation were: (1) coherent array development, which includes the formulation of an analytical model of a coherent multiple-beam array, computer-generated antenna patterns, laboratory verification of these patterns, and formulation of diffraction-limited image dissection techniques, and (2) mixer development, which included achieving Ge:Cu mixer response to 1.43 GHz (with NEP equal to, or less than 1.5 X 10 to the 19th power Hz/watt over this band), analysis of wideband photovoltaic mixing, measurements of 9 mixers of various types, and continued development of a single amplifier to cover the band from 10 MHz to 1.5 GHz. (Author) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOMO7

AD- 844 388 17/5 20/5
RAYTHEON CO WALTHAM MASS RESEARCH DIV

Research Study of a CO2 Laser Radar Transmitter. (U)

DESCRIPTIVE NOTE: Final technical rept. 1 Nov 66-15 Aug 68,
DEC 68 114P Miles,Perry A. ;
REPT. NO. S-1119
CONTRACT: N00014-67-C-0264, ARPA Order-306
PROJ: NR-015-714

UNCLASSIFIED REPORT

DESCRIPTORS: (*OPTICAL RADAR, *GAS LASERS), CARBON DIOXIDE, DESIGN, DOPPLER SYSTEMS, PULSES, AMPLIFIERS, INFRARED TRANSMITTERS (U)

A prototype high power laser radar transmitter at 10.6 micrometers wavelength has been developed for installation at Lincoln Laboratory's Millstone Hill radar site. This report summarizes the three phases of its development: (1) Exploratory work on the properties of dc- and pulse-excited CO2 laser amplifiers and their use in producing trains of high power optical pulses, (2) Design of 1 kW average (10 kW peak) power transmitter, and (3) Operational tests of the transmitter. The signal for a stable oscillator is amplified to a level beyond 200W, formed into a train of 10 microsec pulses by mechanical modulation before amplification to the 10 kW level. All amplifiers are dc-excited. Subjects treated include gain limitations set by spurious oscillation, pulse-to-pulse amplitude stability, oscillator-amplifier interaction, and output beam profile. (Author) (U)

AD- 841 426 17/8 20/5 20/6
LEAR SIEGLER INC SANTA MONICA CALIF ASTRONICS DIV

LASER RADAR DEVELOPMENT. (U)

DESCRIPTIVE NOTE: Progress rept. Mar-Aug 68.
SEP 68 30P
REPT. NO. ADR-731
CONTRACT: N00014-66-C-0157

UNCLASSIFIED REPORT

DESCRIPTORS: (*OPTICAL RADAR, *LASERS), (*LIGHT TRANSMISSION, *ATMOSPHERIC REFRACTION), (*OPTICAL EQUIPMENT, OPTICAL RADAR), RUBY, RODS, YTTRIUM COMPOUNDS, ALUMINUM ALLOYS, GARNET, DOPING, NEODYMIUM, ATMOSPHERES, TURBULENCE, LIGHT, REFRACTIVE INDEX, IMAGE TUBES, FOCUSING, DEGRADATION (U)
IDENTIFIERS: Q-SWITCHING, YAG ALLOYS (U)

Several Q-switching experiments were conducted with the cored Nd:YAG. The 0.5- by 4-inch cored YAG rod was operated Q-switched at repetition rates up to 25 pps, with energy outputs of 200 to 300 millijoules per pulse. The head is capable of higher repetition rates, but the present energy storage system is not. The Q-switched operation is still limited by the short operating life of the Kodak saturable-filter dyes, even though we were able to extend the lifetime by a factor of 10 with better UV shielding. A brief examination of the major factors that determine the degradation by atmospheric turbulence of the performance of a laser radar is presented. Also the design and construction of a second-generation RGI system capable of illuminating and imaging a diffusely reflecting object in a water background at one mile with atmosphere-limited resolution is considered. (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 841 190 17/8 17/9
HUGHES RESEARCH LABS MALIBU CALIF

HIGH POWER, 10.6 MICRONS RADAR TRANSMITTER. (U)

DESCRIPTIVE NOTE: Final rept. 1 Nov 66-30 Jun 68,
AUG 68 289P Smith,Michael R. ;
CONTRACT: N00014-67-C-0237, N00014-68-C-0337

UNCLASSIFIED REPORT

DESCRIPTORS: (*RADAR TRANSMITTERS, DESIGN), (*OPTICAL RADAR, GAS LASERS), CARBON DIOXIDE, LIGHT PULSES, OPTICAL EQUIPMENT, OSCILLATORS, POWER AMPLIFIERS, MECHANICAL DRAWINGS, WIRING DIAGRAMS, OPERATION, CONFIGURATION, DIFFRACTION, GAIN (U)
IDENTIFIERS: DEFENDER PROJECT, MASTER OSCILLATOR POWER AMPLIFIERS, MOPA(MASTER OSCILLATOR POWER AMPLIFIER) (U)

The research efforts and accomplishments on a program to develop a high power, 10.6 microns transmitter suitable for use in an optical radar system are described. Considerations of the radar requirements indicate that the transmitter should be a MOPA device operating in a pulsed optical mode. The physical mechanisms of the CO2 amplifier excitation processes and gain saturation effects are discussed to provide an understanding and a basis for improving the CO2 amplifier performance. Detailed studies of the small signal gain and gain saturation parameters are presented to provide amplifier design criteria. CO2 amplifier medium distortion effects and diffraction effects are discussed with a resulting approach to achieving diffraction limited output performance. The completion of both contracts has resulted in a high power, 10.6 microns radar transmitter which operates in a pulsed optical mode of 10 microsec to 1000 microsec pulse duration at 10,000 to 1,000 pps repetition rate with a 1 kw average power output in an approximately diffraction limited beam. Details of the output power characteristics, physical description and working drawings, power supply manuals, and operating instructions are included. (Author) (U)

AD- 841 118 20/5
SYLVANIA ELECTRONIC SYSTEMS-WEST MOUNTAIN VIEW CALIF

LASER SPECTRAL CONTROL TECHNIQUES. (U)

DESCRIPTIVE NOTE: Final engineering rept. 17 Feb 67-17 Feb 68,
SEP 68 210P Osterink,L. M. ;Foster,J. D. ;
CONTRACT: F30602-67-C-0173
PROJ: AF-6527
TASK: 652701
MONITOR: RADC TR-68-182

UNCLASSIFIED REPORT

DESCRIPTORS: (*LASERS, PHASE LOCKED SYSTEMS), (*OPTICAL RADAR, LASERS), FREQUENCY, STABILIZATION SYSTEMS, NEODYMIUM, GARNET, OPTICAL PUMPING, MODULATION, PULSES, CAVITY RESONATORS, THERMAL PROPERTIES (U)
IDENTIFIERS: PULSE RATE (U)

A mode-locked cs Nd:YAG laser was developed whose output was a pulse train with 28 picosecond pulsewidths and a 2.6 nanosecond pulse repetition frequency. The modes were locked using a LiNbO3 intra-cavity phase modulator. Over one watt of average mode-locked power in the TEMoo mode was obtained. This laser was frequency stabilized by comparing the phase of the output pulse train to that of the modulator drive signal. A shift in pulse phase occurs when the laser c/2L frequency differs from the modulation frequency. By stabilizing the modulation frequency to a frequency standard, one can use the pulse phase shift discriminant to stabilize the cavity length. A novel optical means of detecting the phase shift of the pulse was used and is described. The thermal properties of the Nd:YAG rod were studied in detail. Measurements of the thermally-induced focal length, thermal strain birefringence, dn/dT, and the thermal expansion coefficient of Nd:YAG are presented. The thermal properties are related to achieving optimum transverse mode control in the laser. (Author) (U)

AD- 838 389 17/8 20/5 7/4
NEW YORK UNIV N Y GEOPHYSICAL SCIENCES LAB

OPTICAL SOUNDINGS IV. (U)

DESCRIPTIVE NOTE: Final rept. 1 Apr 67-30 Mar 68,
JUL 68 30P Schotland,R. M. ;
REPT. NO. 68-7
CONTRACT: DAAB07-67-C-0225
MONITOR: ECOM 0225-F

UNCLASSIFIED REPORT

DESCRIPTORS: (*WATER VAPOR, SPECTROSCOPY), (*OPTICAL RADAR, *LASERS), DESIGN, Q BAND, REFLECTORS, RESONANCE, TUNED CIRCUITS, TEMPERATURE, STABILITY, SATURABLE REACTORS, THERMAL STABILITY, REFRACTIVE INDEX, FREQUENCY, MONOCHROMATORS (U)
IDENTIFIERS: Q-SWITCHING (U)

A mode controlled Q switched ruby laser has been assembled using a Hercher resonant reflector and a saturable Q switch continuing cryptocyanine in methanol. The wavelength of the laser is varied by changing the temperature of end plates of the resonant reflector. A change of wavelength of one free spectral range (0.8A) can be obtained in this manner. A rapid scan of one free spectral range of the interior cavity of the reflector (0.1A) is possible at points in the 0.8A range by varying the pressure within the interior cavity. The output energy of the laser was typically 0.4 joules over a 30 nanosecond interval. The line width of the laser was less than 0.1A. (Author) (U)

AD- 837 611 20/5 17/8
AUTONETICS ANAHEIM CALIF

COHERENT OPTICAL ADAPTIVE TECHNIQUES. (U)

DESCRIPTIVE NOTE: Final rept. 1 Mar 67-1 Mar 68,
JUL 68 34P Cathey,Wade T. ;Hayes,
Cecil L. ;Davis,Walter C. ;
REPT. NO. C7-1613.5/501
CONTRACT: F30602-67-C-0227
PROJ: AF-6527
TASK: 652701
MONITOR: RADC TR-68-190

UNCLASSIFIED REPORT

DESCRIPTORS: (*INFRARED LASERS, LIGHT TRANSMISSION), (*LIGHT TRANSMISSION, *COHERENT RADIATION), (*OPTICAL RADAR, FEASIBILITY STUDIES), PHASE MODULATION, SIGNAL-TO-NOISE RATIO, ATMOSPHERES, PHASE SHIFT CIRCUITS, ADAPTIVE SYSTEMS, CORRECTIONS, DISTORTION, PHASE LOCKED SYSTEMS, INTERFERENCE, PHASED ARRAYS, INFRARED RADIATION, GAS LASERS (U)
IDENTIFIERS: *LASERS, *OPTICAL RADAR (U)

A system was designed, constructed and tested which provides dynamic adaptive phase compensation for atmospheric distortions. This demonstrates that arrays can be built larger than previously thought possible because of atmospheric effects. Without adaptive controls, the atmosphere limits the signal-to-noise ratio improvement and the beamwidth reduction which can be obtained using a larger transmit-receive aperture. We accomplished phase compensation for the transmitted beams and the received signals of a two-element 10.6 micron array. By providing adaptive phase control to assure that the two transmitted beams arrived at the target in phase, the power on target was increased by at least 75 percent over the nonadapted case. In addition, the amplitude fluctuations of the received signals were drastically reduced because the adaptive transmitting system eliminated the frequent destructive interference normally seen when two beams are transmitted. Adaptive control of the relative phase of the two received signals before adding also resulted in comparable increases in signal power. The locking of two lasers with a 4.5 MHz difference frequency provided the local oscillator for heterodyne detection. (U)

AD- 831 798 17/8 20/5
LEAR SIEGLER INC SANTA MONICA CALIF ASTRONICS DIV

LASER RADAR DEVELOPMENT. (U)

DESCRIPTIVE NOTE: Progress rept. Sep 67-Mar 68,
MAR 68 88P Jenney,Joe A. ;
REPT. NO. ADR-724
CONTRACT: N00014-66-C-0157

UNCLASSIFIED REPORT

DESCRIPTORS: (*OPTICAL RADAR, LASERS), RADAR, DETECTION, SOLID STATE PHYSICS, COOLING, NEODYMIUM ALLOYS, GOLD ALLOYS, PLATING, PUMPING(ELECTRONICS), RADAR CLUTTER, SIGNAL-TO-NOISE RATIO, PHOTOGRAPHIC IMAGES, RANGE(DISTANCE), SUBMARINES, AIRCRAFT CARRIERS, PERISCOPES, SOUTHEAST ASIA, AIRBORNE, BACKGROUND, FOG, HAZE, ILLUMINATION (U)
IDENTIFIERS: GLASS LASERS, Q-SWITCHING, YAG LASER RODS (U)

The high average power, pulsed solid state laser development continued with the testing of a RGI prototype head using a 1/2 in. x 4 in. cord Nd:YAG rod. This head exhibited a reduction in slope efficiency, from the breadboard results, similar to the 3/4 in. YAG experiments. Tests indicate that the reduced slope efficiency is due to operating the poor optical quality material in a polarized configuration. A cooling experiment with cored and solid Nd:glass rods confirmed that coring a laser rod improves its power handling capability. The RGI prototype laser head was operated at nearly 4 kw input with no significant difficulty. The maximum observed output in the Q-switched mode was 400 millijoules and the maximum pulse repetition rate achieved was 20 PPS. It was found that the absorption cross-section of the excited state of rose bengal dye is too small to permit Q-switching with ND:YAG lasers; however, it does Q-switch Nd:glass because of the smaller gain of Nd in glass as compared to YAG. Several schemes for suppressing whitecap backgrounds in laser radar images were examined through studies of high contrast photographs of the sea. The simple schemes all proved inadequate and the more sophisticated methods were beyond the scope of the present contrast. (U)

AD- 831 761 17/8 20/5 17/9
LEAR SIEGLER INC SANTA MONICA CALIF ASTRONICS DIV

LASER RADAR DEVELOPMENT. (U)

DESCRIPTIVE NOTE: Progress rept. Mar-Aug 67,
MAR 68 99P Jenney,Joe A. ;
REPT. NO. ADR-719
CONTRACT: N00014-66-C-0157

UNCLASSIFIED REPORT

DESCRIPTORS: (*OPTICAL RADAR, *LASERS), IMAGE TUBES, IMAGE CONVERTERS, SOLID STATE PHYSICS, SURFACE TARGETS, SIGNAL-TO-NOISE RATIO, RADAR CLUTTER, RANGE(DISTANCE), PHOTONS, INFRARED FILM, RANGE FINDING, FLUORESCENCE, OCEAN SURVEILLANCE, RADAR, TARGET DISCRIMINATION, WEATHER, BACKGROUND, RESOLUTION, REFLECTIVITY, DOPING, RUBY, OCEAN WAVES, FOG (U)
IDENTIFIERS: FORTRAN, GLASS LASERS, CONTRAST, IMAGES, Q-SWITCHING, ROSE BENGAL, RUBY LASERS, YAG LASER RODS (U)

A range-gated imaging (RGI) laser radar system was constructed and field-tested at the Chesapeake Bay Division of the Naval Research Laboratories to evaluate the capability of RGI systems to provide extremely high contrast image displays. The system employed a ruby laser with 1 to 3 joules output energy in the Q-switched mode and a TRW image converter camera plus a two-stage image intensifier receiver. The field tests indicated that the RGI concept provides extremely high contrast images of diffuse targets in a sea background, under no-whitecap conditions, and that cooperative targets can provide high contrast images even with whitecaps or a land background. The very short exposure times inherent with a Q-switched laser did reduce both the resolution and sensitivity of the imaging receiver; however, the amount of degradation does not limit the application of RGI systems. An experimental program is being directed toward developing a high average power, pulsed, solid-state laser suitable for optical radar systems. Breadboard measurements on cored Nd:YAG rods and some prototype head development has been accomplished. Slope efficiencies greater than 2% were obtained using cored Nd:YAG in breadboard tests. In addition, studies were made on excited-state saturable absorber Q-switch materials. (U)

AD- 826 496 17/8 20/8
RAYTHEON CO WALTHAM MASS RESEARCH DIV

RESEARCH STUDY OF A CO2 LASER RADAR TRANSMITTER. (U)

DESCRIPTIVE NOTE: Semiannual rept. 1 May 67-1 Jan 68,
FEB 68 41P Miles,Perry A. ;
REPT. NO. S-1028
CONTRACT: N00014-67-C-0264, ARPA Order-306
PROJ: NR-015-714

UNCLASSIFIED REPORT

DESCRIPTORS: (*OPTICAL RADAR, GAS LASERS), DESIGN, DOPPLER SYSTEMS, PULSE AMPLIFIERS, CARBON DIOXIDE, POWER AMPLIFIERS, PULSE GENERATORS, OSCILLATORS, MODULATORS, LIGHT PULSES, PERFORMANCE(ENGINEERING) (U)

Exploratory work on the behavior of dc and pulse excited CO2 laser amplifiers has resulted in the design and construction of a prototype laser radar transmitter. It is capable of an output of 1 kW average power in a train of 10 microsec pulses at a pulse repetition rate of 10 kc. This report summarizes the experimental results leading to the final design, outlines the design features and discusses initial tests of the performance of the completed device. (Author) (U)

AD- 803 907   17/9
STANFORD UNIV CALIF STANFORD ELECTRONICS LABS

A PORTABLE GALLIUM-ARSENIDE LASER RADAR. (U)

DESCRIPTIVE NOTE: Technical rept. Jun 65-May 66,
JUN 66   23P   Jackson,D. W. ;
REPT. NO. TR-2301-3, SU-SEL-66-057
CONTRACT: AF 04(695)-745
PROJ: AF-3182
TASK: 318201
MONITOR: SSD   TR-66-134

UNCLASSIFIED REPORT

DESCRIPTORS: (*OPTICAL RADAR, SEMICONDUCTOR DIODES), (*TARGET DISCRIMINATION, *RANGE FINDING), LASERS, GALLIUM ARSENIDES, NITROGEN, ILLUMINATION, PORTABLE EQUIPMENT, INFRARED RADIATION, ELECTROOPTICS (U)

This report describes a simple, portable optical radar that uses a gallium-arsenide diode laser for target illumination. The GaAs-laser radar was constructed to investigate the engineering problems associated with a portable, high-rep-rate optical rangefinder. The system description shows how the electronics and optics of the transmitter and receiver are engineered into a small, battery-powered package. The performance is calculated for various types of targets and compared to experimental results. It is concluded that the small size, small beamwidth, and simplicity of this type radar may prove to be valuable in some applications, normally with cooperative targets. These applications vary from space rendezvous to measuring vehicle separation on high-speed freeways. (Author) (U)

AD- 785 697   17/8
ARMY MISSILE COMMAND REDSTONE ARSENAL ALA PHYSICAL SCIENCES DIRECTORATE

A Novel Laser Radar Range, (U)

72   16P   Wilkinson,E. L. ;Hartman, R. L. ;

UNCLASSIFIED REPORT

DESCRIPTORS: *Optical radar, *Ranges(Facilities), Lasers, Far field (U)

The paper shows (1) far field measurement of the laser radar return are necessary; (2)the validity of scaling laws, atmospheric complications of long ranges and deducing far field properties from near field measurements, make other solutions suspect; (3) the method of optically constructing the far field pattern can produce credible results independent of target properties. Using the optically constructed far field method, measurements can be made on a full scale target with flood lighting. Since the physical length of the range will be about fifty feet, the measurements can be made indoors in a controlled environment. This will eliminate problems caused by the atmosphere, weather and dust. Furthermore, such problems as acoustical vibrations, background and control of target motion are more easily controlled. The facility will be useful in test and development of laser radar systems and discrimination techniques. With a little imagination the facility could be useful in various other applications with only minor modification. (U)

AD- 784 738 20/5 7/4 15/2 4/1
ARMY FOREIGN SCIENCE AND TECHNOLOGY CENTER CHARLOTTESVILLE VA

Adjustable Laser to Provide Evidence of Foreign Material in the Atmosphere. (U)

MAY 73 11P Lohs,K. H. ;
REPT. NO. FSTC-HT-23-1694-73

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: Trans. of Militaertechnik (East Germany) n1 p32-33 1973, by Robert Lagerwerff.

DESCRIPTORS: *Gas detectors, *Tunable lasers, *Optical radar, Remote detectors, Raman spectra, Air pollution, Chemical warfare agents, East Germany, Translations (U)

The report briefly discusses the use of tunable lasers and lidar for remote detection of toxic agents in the atmosphere (i.e. chemical warfare agents or air pollutants). (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOMO7

AD- 784 347 4/2
STANFORD RESEARCH INST MENLO PARK CALIF

Lidar Observations of Sierra Wave Conditions. (U)

DESCRIPTIVE NOTE: Final rept.,
SEP 67 31P Collis,Ronald R. H. ; Fernald,Frederick G. ;Alder,John E. ;
CONTRACT: DAAD07-67-M-6790
PROJ: SRI-6661

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: See also report AD-738 359.

DESCRIPTORS: *Atmospheric motion, *Optical radar, Clear air turbulence, Radiosondes, Clouds, California (U)
IDENTIFIERS: OPDAR (U)

Early in 1967 a series of observations using pulsed ruby and neodymium lidars were made near Independence, California; the object of these observations was to establish the value of lidar for studying air motion in the Sierra wave, with special reference to indications of turbulence. Although no major wave activity occurred, wave motions were observed, both in what appeared to the eye to be clear air and in air where the particulate matter was sufficiently concentrated as to be visible as clouds. Interruptions in the smooth laminar flow in the clear air were observed, and measurements were made of the length, amplitude, and height of waves shown by clouds. It is concluded that lidar observations are of great value in studying wave motion, even in the absence of visible cloud. (Modified author abstract) (U)

AD- 783 612 20/5 17/5
KOLLSMAN INSTRUMENT CORP SYOSSET N Y

Variable Field Off-Axis Coherent System (VOAC). (U)

DESCRIPTIVE NOTE: Final rept.,
JUN 74 118P Gelles,R. ;Stearns,T. ;
CONTRACT: F30602-73-C-0308
MONITOR: RADC TR-74-156

UNCLASSIFIED REPORT

DESCRIPTORS: *Optical radar, *Infrared optical systems, Laser beams, Zoom lenses, Optical equipment, Infrared lasers, Telescopes, Tilt, Carbon dioxide lasers (U)
IDENTIFIERS: Tilted element telescopes (U)

The report summarizes the investigation and design of an unobstructed one meter aperture diffraction limited off-axis optical system. The system is capable of duplexed transmitter and receiver operations. The transmitter optics is capable of handling power levels approaching 50 Kw at 10.6 micrometers while providing variable field coverage with a continuous zoom range of 10 to 1. The receiver is operational in the visible and 10.6 micrometers and can support both acquisition and fine resolution tracking operations for an active laser illuminating system which employs a tracking beam director. (Author) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOM

AD- 783 281 17/8 20/6
HUGHES RESEARCH LABS MALIBU CALIF

Coherent Optical Adaptive Techniques (COAT). (U)

DESCRIPTIVE NOTE: Technical rept. no. 4, 27 Dec 73-26 Mar 74,
APR 74 64P Bridges,W. B. ;Horwitz,L. S. ;Kubo,R. M. ;Pearson,J. L. ;Walsh,T. J. ;
CONTRACT: F30602-73-C-0248, ARPA Order-1279
MONITOR: RADC TR-74-187

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: See also AD-779 668.

DESCRIPTORS: *Optical radar, *Phased arrays, Lasers, Computerized simulation, Self organizing systems, Variations, Fabrication, Reflection (U)
IDENTIFIERS: COAT(Coherent Optical Adaptive Techniques), Coherent optical adaptive techniques, Glint, Atmospheric attenuation (U)

Coherent optical adaptive techniques are designed to overcome degradations experienced by optical beams propagating in media with fixed or time-varying distortions. This report presents results from the calibration phase of an experimental eighteen-element, self-adaptive optical phased array. Initial tests on a turbulent, outdoor propagation range are also presented. Computer simulation studies have demonstrated the advantages of a divider-AGC network and have detailed the theoretical system performance with glints of varying reflectivities, with various signal-to-noise ratios, and with different receiver aperture diameters. Phase shifter hysteresis was found to have a negligible effect on system performance. Laboratory calibration measurements both with and without artificial turbulence show that the experimental COAT system performs very close to theoretical predictions. (Modified author abstract) (U)

AD- 781 974 7/4 13/2
EDGEWOOD ARSENAL ABERDEEN PROVING GROUND MD

Air Pollution Field Studies with a Raman Lidar. (U)

DESCRIPTIVE NOTE: Technical rept. Jan 72-Dec 73,
JUN 74 16P DeLong,Harry P. ;
REPT. NO. ED-TR-74006
PROJ: DA-1-B-622401-AD-27
TASK: 1-B-622401-AD-2702

UNCLASSIFIED REPORT

DESCRIPTORS: *Optical radar, *Raman spectra, *Gas detectors, Air pollution, Scattering cross sections, Remote detectors, Sensitivity (U)
IDENTIFIERS: *Air pollution detection (U)

Raman lidar techniques have been discussed theoretically and sensitivities for various pollutants have been predicted. The results of the present real Raman Lidar indicates pollutant levels between 40-300 ppm are the present sensitivities but very realistic projections based on these data suggest sensitivities between 0.53-7 ppm could be reached if nondispersive detection techniques were used. (Author) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOM07

AD- 781 801 20/6 4/1
RADIATION RESEARCH ASSOCIATES INC FORT WORTH TEX

The Effects of Multiple Scattering on Backscatter Lidar Measurements in Fogs. (U)

DESCRIPTIVE NOTE: Final rept. 1 Aug 30 Nov 73, on Part 2,
JAN 74 93P Blattner,Wolfram G. ;
Collins,Dave G. ;Wells,Michael B. ;
REPT. NO. RRA-T7402
CONTRACT: F19628-73-C-0130
PROJ: AF-7621
TASK: 762106
MONITOR: AFCRL TR-74-0168

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: See also Part 1, AD-772 640.

DESCRIPTORS: *Fog, *Optical radar, *Light scattering, *Visibility, Backscattering, Monochromatic light, Computer programming (U)
IDENTIFIERS: TPART computer programs, TPART-3 computer program (U)

Monte Carlo calculations were run to determine the effect of multiple scattering in the atmosphere on the return signal measured by a Mark VIII ruby lidar system for fogs with meteorological ranges of 80, 100, 200, 300, 400, and 2100 meters. The multiple scattering calculations were made using the TPART-3 Monte Carlo procedure which treats time-dependent light scattering in the atmosphere for collimated sources and receivers. The TPART-3 procedure is described and the results of calculations run to determine time-dependent single and multiple scattered fluxes at the receiver for a ruby lidar are presented for fogs with meteorological ranges between 80 and 2100 meters. (Modified author abstract) (U)

AD- 781 737 20/5 17/5
UNITED AIRCRAFT RESEARCH LABS EAST HARTFORD CONN

Investigation to Determine Characteristics of a Stable-Frequency Pulsed Regenerative-Amplifier CO2 Laser Transmitter. (U)

DESCRIPTIVE NOTE: Final rept. 10 Oct 72-28 Oct 73,
JAN 74 79P Clobes,A. R. ;Berger,P. J. ;Brown,R. T. ;Buczek,C. J. ;
REPT. NO. UARL-M921525-12
CONTRACT: N60921-70-C-0219

UNCLASSIFIED REPORT

DESCRIPTORS: *Optical radar, *Carbon dioxide lasers, Transmitters, Frequency, Stability, Pulse rate, Electric discharges (U)
IDENTIFIERS: TEA lasers (U)

The primary objective of the work is to investigate the feasibility of injection locking a low-power, frequency-stable, CO2 master oscillator to a high-pressure, pulsed electric discharge CO2 laser. While the exploratory work is done at low pulse repetition rates (PRF), the laser design and experimental configuration is guided by the ultimate goal of high PRF operation. To this end, a secondary objective of the program is to investigate the problems associated with high PRF operation. (U)

AD- 780 563 17/5 17/2
POLYTECHNIC INST OF NEW YORK BROOKLYN

Bleachable Absorber Laser Amplifier and Detector: BALAD. (U)

DESCRIPTIVE NOTE: Final technical rept. 1 Jan-31 Dec 72,
FEB 74 88P LaTourrette,James T. ; Newstein,Maurice ;Szeto,S. Y. ;Wright,N. ;

REPT. NO. PINYEP-74-136
CONTRACT: F30602-72-C-0245, ARPA Order-1279
PROJ: AF-1279
TASK: 127900
MONITOR: RADC TR-74-60

UNCLASSIFIED REPORT

DESCRIPTORS: *Infrared detectors, *Infrared receivers, *Optical radar, *Optical communications, Gas lasers, Infrared lasers, Carbon dioxide lasers, Optical equipment components, Light transmission (U)
IDENTIFIERS: BALAD(Bleachable Absorber Laser Amplifier and Detector), Bleachable absorber laser amplifier and detector, Helium xenon lasers, Saturable absorbers, Design (U)

The report describes the continued development of the wide-angle, low noise BALAD receiver (Bleachable Absorber Laser Amplifier and Detector). A xenon-xenon 3.5 micrometer BALAD receiver system has been tested. Experimental results are given. The experiments were hampered by excess noise in the xenon absorber discharge. The three dimensional analysis of the propagation of coherent optical pulses with limited transverse extent, predicts a non-linear self-focussing effect. A modified design of the BALAD receiver using a geometrical loss filter based on this effect is presented and analyzed. The design would facilitate the rejection of noise from the other laser amplifier transitions. (Author) (U)

AD- 779 917 20/5 20/6 17/8 17/5
MASSACHUSETTS INST OF TECH LEXINGTON LINCOLN LAB

Optics Research: 1973:2. (U)

DESCRIPTIVE NOTE: Semiannual rept. 1 Jul-31 Dec 73,
DEC 73 75P Rediker,Robert H. ;
CONTRACT: F19628-73-C-0002, ARPA Order-600
MONITOR: ESD TR-74-17

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: See also AD-770 629.

DESCRIPTORS: *Lasers, *Optical instruments, *Optical radar, Laser beams, Light transmission, Atmosphere models, Thermal blooming, Aerosols, Fog, Carbon dioxide lasers, Gas lasers, Infrared lasers, Interferometers (U)
IDENTIFIERS: Hydrogen fluoride lasers (U)

The report covers work of the Optics Division at Lincoln Laboratory for the period 1 July through 31 December 1973. The topics covered are laser technology and propagation and optical measurements and instrumentation. (Modified author abstract) (U)

AD- 779 854 17/8 15/4
GENERAL RESEARCH CORP ARLINGTON VA

Space Object Laser Analysis (SOLA). (U)

DESCRIPTIVE NOTE: Final technical rept. 1 Oct 72-30 Sep 73,
FEB 74 11P Horrocks,M. ;Chang,E. ;
Eckert,A. ;Gurski,G. ;Sevcik,F. ;
REPT. NO. GRC-CR-1-351
CONTRACT: F30602-73-C-0039
PROJ: AF-6527
TASK: 652701
MONITOR: RADC TR-73-413

UNCLASSIFIED REPORT

DESCRIPTORS: *Optical radar, *Space surveillance systems, Lasers, Signal processing, Identification systems, Space objects (U)
IDENTIFIERS: SOLA(Space Object Laser Analysis), Space object laser analysis (U)

The space object laser analysis (SOLA) provided analytic support to the CORAL (Coherent Optical Radar Laboratory) activities at Rome Air Development Center. The primary effort reported here was performed during the final half of the contract period and is concentrated on the signal processing and data management aspects of space object identification and analysis with a coherent laser radar system. Laser hardware system formats and the relationship and potential use of microwave radars are also discussed. (Author) (U)

AD- 779 668 17/8 20/6
HUGHES RESEARCH LABS MALIBU CALIF

Coherent Optical Adaptive Techniques (COAT). (U)

DESCRIPTIVE NOTE: Quarterly technical rept. no. 3, 27 Sep-26 Dec 73,
JAN 74 81P Bridges,W. B. ;Hensen,S. ; Horwitz,L. S. ;Kubo,R. M. ;Lazarra,S. P. ;

CONTRACT: F30602-73-C-0248
MONITOR: RADC TR-74-108

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: See also AD-776 814.

DESCRIPTORS: *Optical radar, *Phased arrays, Lasers, Self organizing systems, Control systems, Computerized simulation, Electronic equipment, Fabrication, Calibration (U)
IDENTIFIERS: COAT(Coherent Optical Adaptive Techniques), Coherent optical adaptive techniques, Performance evaluation, Atmospheric attenuation (U)

Coherent optical adaptive techniques (COAT) are designed to overcome the distortions experienced by optical beams propagating in a turbulent atmosphere. The report covers the conclusion of the fabrication phase and the start of the calibration of an experimental eighteen-element, self-adaptive, visible optical phased array. Computer simulation results are presented which define optimum AGC performance and which show initial predictions of how the 18-element system will perform. A propagation range complete with a target simulator and associated diagnostics has been constructed for atmospheric measurements with the visible system, and detailed test procedures have been developed. (Modified author abstract) (U)

AD- 778 369 17/8 20/5
UNITED AIRCRAFT RESEARCH LABS EAST HARTFORD CONN

Master Oscillator Techniques for 10 micron Radar. (U)

DESCRIPTIVE NOTE: Final technical rept. 25 Aug 72-24 Feb 74,
APR 74 57P Stein,A. ;
REPT. NO. UARL-N921512-8
CONTRACT: N00014-73-C-0086

UNCLASSIFIED REPORT

DESCRIPTORS: *Carbon dioxide lasers, *Amplitude modulation, *Optical radar, Infrared lasers, Electrooptics, Light modulators, Cadmium tellurides, Chirp radar (U)
IDENTIFIERS: Waveguide lasers (U)

The objective of this program was to investigate the feasibility of using electro-optical coupling modulation of a CO2 waveguide laser to obtain a frequency chirped optical signal for application in 10 micron imaging radar. This AM technique combines the advantage of a relatively high modulation efficiency with a wide bandwidth, independent of the gain profile and the free spectral range of the resonator. The use of a wideband waveguide system is for the purpose of displacing the oscillator spectrum relative to the active line of a post-amplifier such that one chirped AM sideband is effectively isolated. (Modified author abstract) (U)

AD- 777 820 4/2
NATIONAL WEATHER SERVICE STERLING VA TEST AND EVALUATION LAB

Evaluation of a Sperry Lidar Ceilometer. (U)

DESCRIPTIVE NOTE: Final rept. Apr 73-Mar 74,
FEB 74 46P George,David H. ;
PROJ: FAA-ER-450-006
MONITOR: FAA-RD 74-23

UNCLASSIFIED REPORT

DESCRIPTORS: *Meteorological instruments, *Ceiling, *Optical radar, Clouds, Height finding, Performance(Engineering) (U)
IDENTIFIERS: *Ceilometers, Performance evaluation, Instrument characteristics (U)

An evaluation was conducted of a Sperry Lidar Ceilometer during 1973 at the Sterling Research and Development Center. When possible, evaluations were made relative to the Rotating Beam Ceilometer (RBC). The Sperry Lidar Ceilometer is a compact, single-ended cloud height measuring instrument. No special installation tools are needed. Its digital output is compatible with modern data loggers and processors. The lidar uses a Gallium-Arsenide diode array to produce low power 350w energy pulses at the nonvisible 906 nanometer wave length. This, combined with a 10 inch beam diameter, makes the instrument eyesafe. Maximum ranging error against a target placed horizontally from 300 to 4000 ft was found to be 30 ft. Comparison of lidar and 800 ft baseline RBC cloud height measurements produced fairly sharp, clearcut results. (Modified author abstract) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOMO7

AD- 777 533 4/2 17/8
TRANSPORTATION SYSTEMS CENTER CAMBRIDGE MASS

The Measurement of Atmospheric Visibility with Lidar: TSC Field Test Results. (U)

DESCRIPTIVE NOTE: Final rept. Jun 72-Jun 73,
MAR 74 114P Lifsitz,J. R. ;
REPT. NO. TSC-FAA-73-27
MONITOR: FAA-RD 74-29

UNCLASSIFIED REPORT

DESCRIPTORS: *Visibility, *Optical radar, Feasibility studies, Gallium arsenide lasers, Ruby lasers, Slant range, Field tests (U)
IDENTIFIERS: Helium neon lasers (U)

The report represents a technical feasibility study of the use of lidar for determining the atmospheric extinction coefficient in low visibility. Measurements were made with three laser sources: a Q-switched ruby laser, a GaAlAs diode laser array, and a modulated cw helium-neon laser. The work, sponsored by the FAA, is part of a program aimed at measuring and reporting slant visibility. Results of lidar measurements made both in natural coastal fog and in artificial fog are analyzed. Extinction coefficients are obtained with the pulsed systems, using both the 'slope' and 'ratio' methods to analyze the backscatter signature. Corrections for finite laser pulse width are included in the data reduction. (Modified author abstract) (U)

AD- 777 465 9/2 4/2 17/8
AVCO EVERETT RESEARCH LAB INC EVERETT MASS

Raman Lidar Transmissometer Data Processing in Real Time. (U)

DESCRIPTIVE NOTE: Final technical rept. 15 May 72-15 May 73,
AUG 73 41P Leonard,D. A. ;Caputo,B. ;
CONTRACT: N00600-71-C-0372

UNCLASSIFIED REPORT

DESCRIPTORS: *Optical radar, *Optical processing, Real time, Minicomputers, Interfaces, Data processing, Display systems, Gas lasers, Visibility, Glide slope, Computer programming (U)
IDENTIFIERS: *Transmissometers, Nitrogen lasers, Remote sensing (U)

A minicomputer with 8K memory was interfaced with a pulsed nitrogen laser Raman Transmissometer to provide real time data processing and display capability. Self-calibration, normalization and ambient background substraction are included in the minicomputer program software. (Author) (U)

AD- 777 438 4/1 17/8
NAVAL INTELLIGENCE SUPPORT CENTER WASHINGTON D C
TRANSLATION DIV

Laser Sounding of the Atmosphere (Lazernoe Zondirovanie Atmosfery), (U)

DEC 73 20P Zuev,V. E. ;
REPT. NO. NISC-Trans-3483

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: Trans. of Priroda (USSR) n10 p86-93 1972.

DESCRIPTORS: *Atmospheric sounding, *Optical radar, Lasers, Aerosols, Cloud physics, Air pollution, Composition(Property), Gas analysis, Translations, USSR (U)

Laser Sounding of the Atmosphere--Translation.

AD- 776 814 17/8 20/6
HUGHES RESEARCH LABS MALIBU CALIF

Coherent Optical Adaptive Techniques (COAT). (U)

DESCRIPTIVE NOTE: Technical rept. no. 2, 26 Jun-26 Sep 73,
OCT 73 91P Hansen,S. ;Horwitz,L. S. ; Kubo,R. M. ;Lazzara,S. P. ;O'Meara,T. R. ;
CONTRACT: F30602-73-C-0248, ARPA Order-1279
MONITOR: RADC TR-74-38

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: See also AD-772 639.

DESCRIPTORS: *Optical radar, *Phased arrays, Lasers, Self organizing systems, Control systems, Computerized simulation, Electronic equipment, Transmitters, Receivers, Systems engineering (U)
IDENTIFIERS: COAT(Coherent Optical Adaptive Techniques), Coherent optical adaptive techniques (U)

The report covers the fabrication phase of an experimental program to design, fabricate and evaluate an eighteen-element, self-adaptive, laser phased array. Computer simulation efforts were extended to aid in designing system electronics and in analyzing servo-loop performance for rapid glint selection and adaptive array focusing. The hardware configurations for the beamsplitter-mirror assembly (Phasor matrix), electronics and receiver/transmitter channels are described in this report along with the construction progress of the multiglint target hardware and propagation range instrumentation. A revised calibration and measurements program is described which reflects a 3-month delay in the completion of system electronics. (Author) (U)

AD- 775 576 20/6 20/5 17/5
UNITED AIRCRAFT RESEARCH LABS EAST HARTFORD CONN

Research Investigation of Laser Line Profiles (Picosecond Laser Pulses). (U)

DESCRIPTIVE NOTE: Final rept. 1 Aug 66-28 Feb 74,
MAR 74 60P Glenn,William H. ;
REPT. NO. UARL-N920479-44
CONTRACT: N00014-66-C-0344, ARPA Order-1806

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: See also AD-689 548.

DESCRIPTORS: *Laser beams, *Light pulses, *Optical radar, Neodymium lasers, Mode locked lasers, Infrared lasers, Radar signals, Signal processing, Doppler effect (U)

The report discusses the application of picosecond optical pulses to high resolution imaging optical radar. A novel type of signal processing is described. An extensive bibliography of previous work on this contract is included. (Author) (U)

AD- 772 639 17/8 20/6
HUGHES RESEARCH LABS MALIBU CALIF

Coherent Optical Adaptive Techniques (COAT). (U)

DESCRIPTIVE NOTE: Quarterly technical rept. no. 1, 27 Mar-26 Jun 73,
JUL 73 123P Brunner,P. T. ;Lazzara,S. P. ;Nussmeier,T. A. ;O'Mera,T. R. ;Walsh, T. J. ;
CONTRACT: F30602-73-C-0248, ARPA Order-1279
MONITOR: RADC TR-73-384

UNCLASSIFIED REPORT

DESCRIPTORS: *Optical radar, *Phased arrays, Laser beams, Light transmission, Attenuation, Lasers, Systems engineering, Computerized simulation (U)
IDENTIFIERS: Design, Atmospheric attenuation, COAT(Coherent Optical Adaptive Techniques), Coherent optical adaptive techniques (U)

Coherent optical adaptive techniques (COAT) can be applied to overcome the deleterious effects of atmospheric turbulence. The report covers the design phase of an experimental program to design, fabricate and evaluate an eighteen-element, self-adaptive, optical phased array. In addition, a computer simulation program developed to aid in system design and performance prediction is also described. Results are presented on preliminary experiments performed with an existing seven-element COAT system. Further experiments were performed with different piezoelectric ceramic phase-shifter configurations and with improved servo control electronic systems and are described here. Techniques for offset pointing of the phased array are discussed. A flexible phasor matrix structure is described in which radiating array patterns can be easily changed. Atmospheric characterization measurements performed on the 94 meter test range are described. The design of a dynamic multiglint target system is given. (Modified author abstract) (U)

AD- 771 805 17/8
OHIO STATE UNIV COLUMBUS ELECTROSCIENCE LAB

EO Cross Section Studies. (U)

DESCRIPTIVE NOTE: Final rept. 1 Jul 72-30 Jun 73,
NOV 73 80P Damon,E. K. ;Levis,C. A. ;Meadors,J. G. ;Reinhardt,G. W. ;
REPT. NO. ESL-3486-1
CONTRACT: F33615-72-C-2064
MONITOR: AFAL TR-73-338

UNCLASSIFIED REPORT

DESCRIPTORS: *Optical radar, *Radar cross sections, Gallium arsenide lasers, Neodymium lasers, Low light levels, Television systems, Target acquisition, Atmospheric motion, Turbulence, Scattering, Laser safety, Aircraft, Targets (U)
IDENTIFIERS: YAG lasers (U)

An experimental facility for the measurement of laser radar cross sections (LRCS) of aircraft targets is analyzed and the essential operational parameters determined. It is demonstrated that significant data can be acquired with a system including a GaAs or Nd:YAG laser illuminator and a low light level TV. Specifications for subsystems and the data processor are given. (Author) (U)

AD- 770 629   20/5   20/6   17/8   17/5
MASSACHUSETTS INST OF TECH LEXINGTON LINCOLN LAB

Optics Research, 1973:1. (U)

DESCRIPTIVE NOTE: Semiannual rept. 1 Jan-30 Jun 73,
OCT 73   82P   Rediker,Robert H. ;
CONTRACT: F19628-73-C-0002, ARPA Order-600
MONITOR: ESD   TR-73-231

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: See also report dated 31 Dec 72, AD-762 320.

DESCRIPTORS: *Lasers, *Optical instruments, *Optical radar, Infrared lasers, Gas lasers, Carbon dioxide lasers, Laser beams, Light transmission, Atmosphere models, Thermal blooming, Infrared detection, Air pollution, Transfer functions, Plasma generators (U)
IDENTIFIERS: Laser produced plasmas, Laser spectroscopy (U)

The report covers work of the Optics Division at Lincoln Laboratory for the period 1 January through 30 June 1973. The topics covered are laser technology and propagation and optical measurements and instrumentation. (Modified author abstract) (U)

AD- 767 427   20/5   17/8   17/5
UNITED AIRCRAFT RESEARCH LABS EAST HARTFORD CONN

Picosecond Laser Pulses. (U)

DESCRIPTIVE NOTE: Semi-Annual technical rept. 1 Mar-31 Aug 73,
SEP 73   44P   Glenn,William H. ;
REPT. NO. UARL-M920479-42
CONTRACT: N00014-66-C-0344, ARPA Order-1806

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: See also AD-758 059.

DESCRIPTORS: (*LASERS, LIGHT PULSES), (*OPTICAL RADAR, RESOLUTION), SYNTHETIC APERTURE RADAR, RADAR IMAGES, DOPPLER EFFECT, MATHEMATICAL MODELS, FOURIER ANALYSIS (U)
IDENTIFIERS: SIGNAL PROCESSING, MATHEMATICAL ANALYSIS, DATA PROCESSING, IMAGE CONVERTERS, IMAGES (U)

The report reviews briefly the application of ultrashort pulses to imaging radars, and shows the need for an alternate signal processing scheme. A mathematical description and physical interpretation of frequency domain sampling is presented and its application to time scaling and matched filtering is discussed. An experiment to demonstrate the technique is outlined and will be carried out during the next reporting period. (U)

AD- 767 396   4/1
UNIVERSITY COLL LONDON (ENGLAND) DEPT OF PHYSICS AND ASTRONOMY

Determination of Air Density, Temperature and Winds at High Altitude. (U)

DESCRIPTIVE NOTE: Interim rept. 1 Feb 72-31 Jan 73,
MAR 73   19P   Groves,Gerald V. ;Rees, David ;
REPT. NO. Scientific-1
CONTRACT: AF-AFOSR-2264-72
PROJ: AF-8605
TASK: 860501
MONITOR: AFCRL   TR-73-0419

UNCLASSIFIED REPORT

DESCRIPTORS: (*UPPER ATMOSPHERE, SCIENTIFIC RESEARCH), IONOSPHERE, WIND, ATMOSPHERIC TEMPERATURE, DENSITY, DIURNAL VARIATIONS, GREAT BRITAIN (U)
IDENTIFIERS: OPTICAL RADAR, ATMOSPHERIC DENSITY, ATMOSPHERIC CIRCULATION, REMOTE SENSING, *THERMOSPHER(U)

The report reviews the research carried out at University College London in the following areas: The development and comparison of techniques for extending and improving wind and temperature measurement; winds and temperatures in the high-latitude and equatorial thermosphere; and, atmospheric circulation. (Modified author abstract) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY   SEARCH CONTROL NO. ZOMO7

AD- 766 962   17/8   18/2
PENNSYLVANIA STATE UNIV UNIVERSITY PARK DEPT OF ELECTRICAL ENGINEERING

An Experiment and Theoretical Investigation of Detection Statistics for Optical Frequency Radar Systems and Communication System. (U)

DESCRIPTIVE NOTE: Final rept. 1 Jul 70-30 Jun 73,
JUL 73   9P   Lachs,Gerald ;
CONTRACT: DAHC04-70-C-0046
PROJ: DA-2-0-061102-B-31-E
MONITOR: AROD   8936:10-E

UNCLASSIFIED REPORT

DESCRIPTORS: (*OPTICAL RADAR, QUANTUM STATISTICS), (*OPTICAL COMMUNICATIONS, QUANTUM STATISTICS), PHOTONS, COUNTING METHODS, DETECTION, PROBABILITY (U)

The research accomplishments on detection statistics for opdar and light communications are briefly summarized. Details of the accomplishments are contained in the list of papers reported in the publications section of this report. (U)

AD- 766 749 20/6 17/5
MARTIN MARIETTA AEROSPACE ORLANDO FLA

Acousto-Optic Isolator (AOI). (U)

DESCRIPTIVE NOTE: Final rept. 16 Jun-15 Dec 72,
SEP 73 104P Corcoran,Vincent J. ;Smith,
William T. ;Martin,James M. ;
REPT. NO. OR-12348
CONTRACT: F30602-72-C-0475
MONITOR: RADC TR-73-245

UNCLASSIFIED REPORT

DESCRIPTORS: (*OPTICAL RADAR, ATTENUATORS), (*INFRARED RADIATION, FREQUENCY SHIFT), OPTICAL EQUIPMENT, ACOUSTIC EQUIPMENT, SEMICONDUCTORS, PIEZOELECTRIC CRYSTALS, MODULATORS, INFRARED LASERS, FEEDBACK, DESIGN (U)
IDENTIFIERS: MASTER OSCILLATOR POWER AMPLIFIERS, CARBON DIOXIDE LASERS (U)

Coherent CO2 radars having amplification stages following a CO2 master oscillator exhibit spurious feedback which tends to pull the frequency of the signal. The acousto-optic isolator (AOI) concept has shown promise to correct the feedback problem. Under this program, a number of AOI devices have been constructed, tested, and compared. Using a master oscillator/power amplifier simulator, instability of the master oscillator has been determined to be a function of feedback level, the difference between feedback signal and oscillator frequencies, and averaging time. AOI devices are shown to enhance the stability of the master oscillator. (Author) (U)

AD- 766 678 17/8
ARMY ELECTRONICS COMMAND FORT MONMOUTH N J

A Proposed Versatile Photon Counter System for Laser Radar. (U)

DESCRIPTIVE NOTE: Research and development technical rept.,
SEP 73 26P Wade,Gerald T. ;Barber,
Teddy L. ;Armstrong,Robert ;
REPT. NO. ECOM-5508
PROJ: DA-1-T-061102-B-53-A
TASK: 1-T-061102-B-53-A-19

UNCLASSIFIED REPORT

DESCRIPTORS: (*OPTICAL RADAR, DATA PROCESSING), (*PHOTONS, COUNTING METHODS), DESIGN, ATMOSPHERIC SOUNDING, ANALOG-TO-DIGITAL CONVERTERS, LASERS (U)
IDENTIFIERS: MINICOMPUTERS, DATA PROCESSING, OPTICAL DATA (U)

A high-speed, multi-channel photon counting system has been proposed for use with a variety of laser radar (lidar) experiments. It utilizes two solid state buffer memories to replace the large array of counters normally associated with such a system and a minicomputer to handle data manipulation and display. The speed and versatility make the system a reasonable alternative to systems presently in use. System features include a 250 MHz photon counting rate, 100 nanosecond minimum sample interval, up to 512 channel data accumulation with sub-nanosecond switching times between channels, and a maximum laser transmitter repetition rate of 10 KHz. This system offers several advantages over presently available systems, such as allowing the higher laser repetition rates needed to monitor a rapidly fluctuating atmosphere without sacrificing spatial resolution or the total number of data channels, and enabling real-time modification of the system operating parameters as a function of incoming data. This paper describes the parameters influencing the design of such a system. (Author) (U)

AD- 765 842 17/5 17/2
POLYTECHNIC INST OF BROOKLYN FARMINGDALE N Y

Bleachable Absorber Laser Amplifier and Detector (BALAD). (U)

DESCRIPTIVE NOTE: Interim technical rept. Jan-Jul 72,
MAY 73 54P LaTourrette,James T. ; Wilson,John ;
REPT. NO. PIBEP-73-127
CONTRACT: F30602-72-C-0245, ARPA Order-1279
MONITOR: RADC TR-73-172

UNCLASSIFIED REPORT

DESCRIPTORS: (*INFRARED DETECTORS, DESIGN), (*OPTICAL RADAR, INFRARED DETECTORS), (*OPTICAL COMMUNICATIONS, INFRARED DETECTORS), GAS LASERS, INFRARED LASERS, INFRARED RECEIVERS, OPTICAL EQUIPMENT COMPONENTS, SIGNAL-TO-NOISE RATIO (U)
IDENTIFIERS: XENON LASERS, CARBON DIOXIDE LASERS, ABSORBERS(EQUIPMENT), SATURATION, IBM 370 COMPUTERS, SULFUR HEXAFLUORIDE (U)

The report describes the continued development of the wide-angle, low noise BALAD receiver (Bleachable Absorber Laser Amplifier and Detector). The spatial and frequency resolution of a SF6 saturable absorber in a 10.6 micrometer BALAD configuration has been measured. The experimental results agree with the theoretical predictions. The components of a Xenon-Xenon 3.5 micrometer BALAD system have been assembled, and experimental tests have been initiated. The theoretical analysis of the propagation of coherent optical pulses in resonant media has been extended to three dimensions, but only preliminary results have been obtained. (Author) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOM07

AD- 765 213 17/8
OWENS-ILLINOIS INC PITTSBURGH PA FECKER SYSTEMS DIV

Optical Radar Angle Tracking Mount. (U)

DESCRIPTIVE NOTE: Interim rept. Apr 72-May 73,
JUL 73 90P Thompson,George J. ;Pappas, Spiro ;
REPT. NO. F(4)-864-047-022-2251
CONTRACT: F30602-72-C-0192, ARPA Order-1279
MONITOR: RADC TR-73-205

UNCLASSIFIED REPORT

DESCRIPTORS: (*SUPPORTS, DESIGN), (*OPTICAL RADAR, RADAR TRACKING), JOURNAL BEARINGS, THRUST BEARINGS, HYDROSTATIC PRESSURE, HEATING, SOLAR RADIATION, LUBRICATION, VISCOSITY (U)
IDENTIFIERS: *OPTICAL RADAR, TRACKING MOUNTS, DESIGN CRITERIA (U)

The report consists of an environmental analysis in two parts: random solar heat pointing error; and the hydrostatic bearings design in three parts: azimuth axis thrust bearing, azimuth axis radial bearing, and evaluation axis radial bearing. These subjects are critical design criteria for the optical radar angle tracking mount. (Author) (U)

AD- 764 144 17/5 17/8 20/6
STANFORD RESEARCH INST MENLO PARK CALIF

Tactical Considerations of Atmospheric Effects on Laser Propagation. (U)

DESCRIPTIVE NOTE: Final rept. 13 Jan 67-12 Jan 68, on Phase 2,
FEB 68 53P Allen,Robert J. ;Uthe, Edward E. ;Evans,William E. ;
CONTRACT: N00019-67-C-0270
PROJ: SRI-6540

UNCLASSIFIED REPORT

DESCRIPTORS: (*COHERENT RADIATION, ATMOSPHERIC MOTION), (*OPTICAL RADAR, TARGET DISCRIMINATION), LASERS, LIGHT HOMING, ATTENUATION, SCATTERING, TACTICAL WEAPONS (U)
IDENTIFIERS: *LASER BEAMS, LASERS, OPTICAL RADAR, ATMOSPHERES, ATTENUATION (U)

The report describes the progress made during the second year (Phase II) of a study of atmospheric effects on laser propagation in connection with the operation of certain tactical weapon systems. Included are a detailed discussion of the fourth quarter's work and references to work previously reported in the three quarterly reports. A computer study was initiated in the fourth quarter to determine the optimum sensor depression angle and range to target as functions of the atmosphere in connection with an aircraft carrying a laser receiver. A small-volume false target (smoke, dust, etc.) was simulated and the receiver incident power levels from false and true targets as a function of the sensor depression angle and eight independent variables were calculated. Before the optimum values of depression angle and range can be determined, however, additional simulated runs are needed; these are planned during the early part of Phase III. An error analysis of the Mk VI lidar when used with the cooperative target array was completed and confirmed that lidar provides an accurate method of conducting transmission measurements. Also described is a method for injecting a calibration reference pulse into the PMT output log amplifier. (Modified author abstract) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOMO7

AD- 762 335 4/1
FRAUNHOFER-GESELLSCHAFT GARMISCH-PARTENKIRCHEN (WEST GERMANY)

Atmospheric Aerosols between 700 and 3000 m above Sea Level. Part VI. Parameterization of Aerosol Eddy Diffusion Controlled by Aerological Parameters. (U)

DESCRIPTIVE NOTE: Final technical rept.,
FEB 73 128P Reiter,Reinnold ;Sladkovic, Rudolf ;Carnuth,Walter ;
CONTRACT: DAJA37-70-C-2647
PROJ: DA-1-T-061102-B-53-A

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: See also Part V dated Jul 71, AD-732 877.

DESCRIPTORS: (*ATMOSPHERIC SOUNDING, AEROSOLS), (*AEROSOLS, DIFFUSION), OPTICAL RADAR, TROPOSPHERE, RADIOSONDES, ATMOSPHERIC TEMPERATURE, HEAT TRANSFER, NUCLEATION, ATMOSPHERIC MOTION, TELEMETER SYSTEMS, DETECTORS, DATA PROCESSING, STATISTICAL ANALYSIS, CLEAR AIR TURBULENCE, BOUNDARY LAYER, BAROMETRIC PRESSURE, WEST GERMANY (U)
IDENTIFIERS: OPTICAL RADAR (U)

Studies are reported for the effects of aerological fine-structure characteristics upon vertical distribution of aerosols. Emphasis largely on concluding the development of a parameterization of the relationship between aerological parameters and certical eddy aerosol diffusion. This parameterization is based (a) on a recently improved theoretical derivation of exchange coefficient from vertical profiles of particle concentration; (b) on the entirety of data obtained in several years; and thus (c) on adequate statistical significance. (U)

AD- 765 842 17/5 17/2
POLYTECHNIC INST OF BROOKLYN FARMINGDALE N Y

Bleachable Absorber Laser Amplifier and Detector (BALAD). (U)

DESCRIPTIVE NOTE: Interim technical rept. Jan-Jul 72,
MAY 73 54P LaTourrette,James T. ;
Wilson,John ;
REPT. NO. PIBEP-73-127
CONTRACT: F30602-72-C-0245, ARPA Order-1279
MONITOR: RADC TR-73-172

UNCLASSIFIED REPORT

DESCRIPTORS: (*INFRARED DETECTORS, DESIGN), (*OPTICAL RADAR, INFRARED DETECTORS), (*OPTICAL COMMUNICATIONS, INFRARED DETECTORS), GAS LASERS, INFRARED LASERS, INFRARED RECEIVERS, OPTICAL EQUIPMENT COMPONENTS, SIGNAL-TO-NOISE RATIO (U)
IDENTIFIERS: XENON LASERS, CARBON DIOXIDE LASERS, ABSORBERS(EQUIPMENT), SATURATION, IBM 370 COMPUTERS, SULFUR HEXAFLUORIDE (U)

The report describes the continued development of the wide-angle, low noise BALAD receiver (Bleachable Absorber Laser Amplifier and Detector). The spatial and frequency resolution of a SF6 saturable absorber in a 10.6 micrometer BALAD configuration has been measured. The experimental results agree with the theoretical predictions. The components of a Xenon-Xenon 3.5 micrometer BALAD system have been assembled, and experimental tests have been initiated. The theoretical analysis of the propagation of coherent optical pulses in resonant media has been extended to three dimensions, but only preliminary results have been obtained. (Author) (U)

AD- 765 213 17/8
OWENS-ILLINOIS INC PITTSBURGH PA FECKER SYSTEMS DIV

Optical Radar Angle Tracking Mount. (U)

DESCRIPTIVE NOTE: Interim rept. Apr 72-May 73,
JUL 73 90P Thompson,George J. ;Pappas, Spiro ;
REPT. NO. F(4)-864-047-022-2251
CONTRACT: F30602-72-C-0192, ARPA Order-1279
MONITOR: RADC TR-73-205

UNCLASSIFIED REPORT

DESCRIPTORS: (*SUPPORTS, DESIGN), (*OPTICAL RADAR, RADAR TRACKING), JOURNAL BEARINGS, THRUST BEARINGS, HYDROSTATIC PRESSURE, HEATING, SOLAR RADIATION, LUBRICATION, VISCOSITY (U)
IDENTIFIERS: *OPTICAL RADAR, TRACKING MOUNTS, DESIGN CRITERIA (U)

The report consists of an environmental analysis in two parts: random solar heat pointing error; and the hydrostatic bearings design in three parts: azimuth axis thrust bearing, azimuth axis radial bearing, and evaluation axis radial bearing. These subjects are critical design criteria for the optical radar angle tracking mount. (Author) (U)

AD- 764 144 17/5 17/8 20/6
STANFORD RESEARCH INST MENLO PARK CALIF

Tactical Considerations of Atmospheric Effects on Laser Propagation. (U)

DESCRIPTIVE NOTE: Final rept. 13 Jan 67-12 Jan 68, on Phase 2,
FEB 68 53P Allen,Robert J. ;Uthe, Edward E. ;Evans,William E. ;
CONTRACT: N00019-67-C-0270
PROJ: SRI-6540

UNCLASSIFIED REPORT

DESCRIPTORS: (*COHERENT RADIATION, ATMOSPHERIC MOTION), (*OPTICAL RADAR, TARGET DISCRIMINATION), LASERS, LIGHT HOMING, ATTENUATION, SCATTERING, TACTICAL WEAPONS (U)
IDENTIFIERS: *LASER BEAMS, LASERS, OPTICAL RADAR, ATMOSPHERES, ATTENUATION (U)

The report describes the progress made during the second year (Phase II) of a study of atmospheric effects on laser propagation in connection with the operation of certain tactical weapon systems. Included are a detailed discussion of the fourth quarter's work and references to work previously reported in the three quarterly reports. A computer study was initiated in the fourth quarter to determine the optimum sensor depression angle and range to target as functions of the atmosphere in connection with an aircraft carrying a laser receiver. A small-volume false target (smoke, dust, etc.) was simulated and the receiver incident power levels from false and true targets as a function of the sensor depression angle and eight independent variables were calculated. Before the optimum values of depression angle and range can be determined, however, additional simulated runs are needed; these are planned during the early part of Phase III. An error analysis of the Mk VI lidar when used with the cooperative target array was completed and confirmed that lidar provides an accurate method of conducting transmission measurements. Also described is a method for injecting a calibration reference pulse into the PMT output log amplifier. (Modified author abstract) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOMO7

AD- 762 335 4/1
FRAUNHOFER-GESELLSCHAFT GARMISCH-PARTENKIRCHEN (WEST GERMANY)

Atmospheric Aerosols between 700 and 3000 m above Sea Level. Part VI. Parameterization of Aerosol Eddy Diffusion Controlled by Aerological Parameters. (U)

DESCRIPTIVE NOTE: Final technical rept.,
FEB 73 128P Reiter,Reinhold ;Sladkovic, Rudolf ;Carnuth,Walter ;
CONTRACT: DAJA37-70-C-2647
PROJ: DA-1-T-061102-B-53-A

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: See also Part V dated Jul 71, AD-732 877.

DESCRIPTORS: (*ATMOSPHERIC SOUNDING, AEROSOLS), (*AEROSOLS, DIFFUSION), OPTICAL RADAR, TROPOSPHERE, RADIOSONDES, ATMOSPHERIC TEMPERATURE, HEAT TRANSFER, NUCLEATION, ATMOSPHERIC MOTION, TELEMETER SYSTEMS, DETECTORS, DATA PROCESSING, STATISTICAL ANALYSIS, CLEAR AIR TURBULENCE, BOUNDARY LAYER, BAROMETRIC PRESSURE, WEST GERMANY (U)
IDENTIFIERS: OPTICAL RADAR (U)

Studies are reported for the effects of aerological fine-structure characteristics upon vertical distribution of aerosols. Emphasis largely on concluding the development of a parameterization of the relationship between aerological parameters and certical eddy aerosol diffusion. This parameterization is based (a) on a recently improved theoretical derivation of exchange coefficient from vertical profiles of particle concentration; (b) on the entirety of data obtained in several years; and thus (c) on adequate statistical significance. (U)

AD- 762 320   20/5   20/6   17/8   17/5
MASSACHUSETTS INST OF TECH LEXINGTON LINCOLN LAB

Optics Research, 1972:2. (U)

DESCRIPTIVE NOTE: Semiannual rept. 1 Jul-31 Dec 72,
DEC 72   62P   Rediker,Robert H. ;
CONTRACT: F19628-73-C-0002, ARPA Order-600
MONITOR: ESD   TR-72-364

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: See also report dated 19 Dec 72, AD-754 939.

DESCRIPTORS: (*LASERS, SCIENTIFIC RESEARCH), (*OPTICAL INSTRUMENTS, SCIENTIFIC RESEARCH), (*OPTICAL RADAR, SCIENTIFIC RESEARCH), INFRARED LASERS, GAS LASERS, COHERENT RADIATION, LIGHT TRANSMISSION, ATMOSPHERE MODELS, PLASMA GENERATORS, OPTICAL IMAGES, INFRARED IMAGES, TRANSFER FUNCTIONS (U)
IDENTIFIERS: LASER BEAMS, LASER SPECTROSCOPY, LASER PRODUCED PLASMAS, CARBON DIOXIDE LASERS, THERMAL BLOOMING (U)

The report covers work of the Optics Division at Lincoln Laboratory for the period 1 July though 31 December 1972. The topics covered are laser technology and propagation, and optical measurements and instrumentation. (Modified author abstract) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY   SEARCH CONTROL NO. ZOMO7

AD- 760 128   4/2   1/2
STANFORD RESEARCH INST MENLO PARK CALIF

Lidar Observations of Slant Range Visibility for Aircraft Landing Operations, (U)

FEB 73   46P   Viezee,William ;Oblanas,John ;Collis,Ronald T. H. ;
REPT. NO. Scientific-1
CONTRACT: F19628-71-C-0152
PROJ: AF-6670
TASK: 667004
MONITOR: AFCRL   TR-73-0146

UNCLASSIFIED REPORT

DESCRIPTORS: (*OPTICAL RADAR, VISIBILITY), (*AIRCRAFT LANDINGS, VISIBILITY), METEOROLOGICAL INSTRUMENTS, LASERS, FOG, RANGE FINDING, OPTICAL EQUIPMENT, BACKSCATTERING, MEASUREMENT (U)
IDENTIFIERS: RUBY LASERS, SLANT RANGE (U)

During July 1972, a scanning ruby lidar was operated in support of the AFCRL fog field program at Vandenberg AFB, California. In addition to observations made during thermal fog dispersal tests, backscatter data were collected during 14 separate periods of dense natural fog. Values of slant visual range computed from these data are compared with information on the visibility conditions obtained from available AFCRL instrumentation. Although no detailed,quantitative evaluation of the lidar observation was feasible, the data comparison shows that the lidar provided visibility information compatible with that supplied by the more conventional measuring devices. (Author) (U)

AD- 758 059 20/5 17/8 17/5
UNITED AIRCRAFT RESEARCH LABS EAST HARTFORD CONN

Picosecond Laser Pulses. (U)

DESCRIPTIVE NOTE: Semi-Annual technical rept. 1 Aug 72-28 Feb 73,
MAR 73 40P Glenn,William H. ;
REPT. NO. UARL-M920479-39
CONTRACT: N00014-66-C-0344, ARPA Order-1806

UNCLASSIFIED REPORT

DESCRIPTORS: (*LASERS, LIGHT PULSES), (*OPTICAL RADAR, RESOLUTION), RADAR IMAGES, FREQUENCY STABILIZERS, DOPPLER EFFECT (U)
IDENTIFIERS: *LASERS, *YTTRIUM ALUMINUM GARNET, NEODYMIUM LASERS, DATA PROCESSING, IMAGE CONVERTERS, IMAGES (U)

The report discusses the application of ultrafast laser pulses to high resolution imaging radar systems. The principal results reported include the successful demonstration of a laboratory scale range Doppler radar, and a discussion of novel ultrafast data processing techniques. (Author) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOM07

AD- 757 914 20/6 17/5
MARTIN MARIETTA AEROSPACE ORLANDO FLA

Acousto-Optic Isolator (ACI). (U)

DESCRIPTIVE NOTE: Interim technical rept.,
OCT 72 43P Corcoran,Vincent J. ;Smith, William T. ;Martin,James M. ;
REPT. NO. OR-12329
CONTRACT: F30602-72-C-0475, ARPA Order-1279
MONITOR: RADC TR-73-52

UNCLASSIFIED REPORT

DESCRIPTORS: (*OPTICAL RADAR, ATTENUATORS), (*INFRARED RADIATION, FREQUENCY SHIFT), OPTICAL EQUIPMENT, ACOUSTIC EQUIPMENT, MODULATORS, GERMANIUM, INFRARED LASERS (U)
IDENTIFIERS: MASTER OSCILLATOR POWER AMPLIFIERS, CARBON DIOXIDE LASERS, HELIUM NEON LASERS (U)

The effort has examined the isolation capabilities and overall operational efficiency of employing an acousto-optical frequency translator for the purposes of suppressing optical feedback generated instabilities in a laser MOPA chain. The operating principle is based on decoupling optical feedback from sustained laser oscillation by frequency translating the feedback such that it falls outside the gain bandwidths of any of the CO transition lines. Current progress has demonstrated successful optical feedback isolation, but, has experienced spurious acoustical and RF induced heating of the frequency translator which has limited its overall efficiency to approximately 10 percent. (Author) (U)

AD- 757 361 17/5 17/2
POLYTECHNIC INST OF BROOKLYN FARMINGDALE N Y

Bleachable Absorber Laser Amplifier and Detector (BALAD). (U)

DESCRIPTIVE NOTE: Final rept. 18 Nov 70-17 Nov 71,
OCT 72 75P Gould,Gordon ;Latourrette, James T. ;
REPT. NO. PIBEP-72-107
CONTRACT: F30602-71-C-0024, ARPA Order-1279
MONITOR: RADC TR-72-313

UNCLASSIFIED REPORT

DESCRIPTORS: (*INFRARED DETECTORS, DESIGN), (*OPTICAL RADAR, INFRARED DETECTORS), (*OPTICAL COMMUNICATIONS, INFRARED DETECTORS), GAS LASERS, INFRARED LASERS, OPTICAL EQUIPMENT COMPONENTS, FEASIBILITY STUDIES, WAVEGUIDES, SIGNAL-TO-NOISE RATIO, GAIN (U)
IDENTIFIERS: XENON LASERS, CARBON DIOXIDE LASERS, ABSORBERS(EQUIPMENT), SATURATION (U)

A detailed feasibility and design study has been made on the wide-angle, low noise BALAD receiver (Bleachable Absorber Laser Amplifier and Detector). Expressions have been derived for the achievable field-of-view, maximum gain and other specifications in terms of the dimensions and the measurable properties of the laser and absorber gases. Virtually error free detection is assured for signal pulses > 100 photons. A figure-of-merit has been measured for several absorber gases screened from the literature. BALAD receivers with 4000 resolution element field-of-view are feasible using SF6 and a CO2 amplifier at 10.6micrometers and Xe with Xe at 3.5micrometers. The use of the latter is recommended for the experimental test of the BALAD receiver. Three compact absorber configurations have been considered and will be further investigated. Application is to optical radar and to optical communications where signal direction is uncertain. (Author) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. Z0M07

AD- 754 939 20/5 20/6 17/8 17/5
MASSACHUSETTS INST OF TECH LEXINGTON LINCOLN LAB

Optics Research, 1972:1. (U)

DESCRIPTIVE NOTE: Semiannual rept. 1 Jan-30 Jun 72,
DEC 72 105P Rediker,Robert H. ;
CONTRACT: F19628-70-C-0230, ARPA Order-600
MONITOR: ESD TR-72-195

UNCLASSIFIED REPORT

DESCRIPTORS: (*LASERS, SCIENTIFIC RESEARCH), (*OPTICAL INSTRUMENTS, SCIENTIFIC RESEARCH), (*OPTICAL RADAR, SCIENTIFIC RESEARCH), INFRARED LASERS, COHERENT RADIATION, LIGHT TRANSMISSION, ATMOSPHERE MODELS, PLASMA GENERATORS, GAS LASERS, FREQUENCY MULTIPLIERS, ZINC SULFIDES, AIR POLLUTION, SPECTRUM ANALYZERS, EXHAUST GASES, TRANSFER FUNCTIONS, RANGE FINDING (U)
IDENTIFIERS: LASER BEAMS, LASER PRODUCED PLASMAS, LASER SPECTROSCOPY, AIR POLLUTION DETECTION, CARBON DIOXIDE LASERS, DATA PROCESSING, IMAGE CONVERTERS, IMAGES, INFRARED UPCONVERSION, SULFUR DIOXIDE, THERMAL BLOOMING (U)

The report covers work of the Optics Division at Lincoln Laboratory for the period 1 January through 30 June 1972. The topics covered are laser technology and propagation, optical measurements and instrumentation, and laser radar. Additional information on the optics program may be found in the semiannual technical summary reports to the Advanced Research Projects Agency. (Author) (U)

AD- 749 543 17/5 17/2
POLYTECHNIC INST OF BROOKLYN FARMINGDALE N Y

Bleachable Absorber Laser Amplifier and
Defector (BALAD). (U)

DESCRIPTIVE NOTE: Semi-annual rept.,
APR 72 40P Gould,Gordon ;LaTourrette,
James T. ;
REPT. NO. PIBEP-72-106
CONTRACT: F30602-71-C-0024, ARPA Order-1279
MONITOR: RADC TR-72-110

UNCLASSIFIED REPORT

DESCRIPTORS: (*INFRARED DETECTORS, DESIGN), (*OPTICAL RADAR, INFRARED DETECTORS), (*OPTICAL COMMUNICATIONS, INFRARED DETECTORS), GAS LASERS, INFRARED LASERS, WAVEGUIDES, SIGNAL-TO-NOISE RATIO, GAIN (U)
IDENTIFIERS: XENON LASERS, CARBON DIOXIDE LASERS (U)

A detailed feasibility and design study has been made on the wide-angle, low noise BALAD receiver (Bleachable Absorber Laser Amplifier and Detector). Expressions have been derived for the achievable field-of-view, maximum gain and other specifications in terms of the dimensions and the measurable properties of the laser and absorber gases. Virtually error free detection is assured for signal pulses >100 photons. A figure-of-merit has been measured for several absorber gases screened from the literature. BALAD receivers with 4000 resolution element field-of-view are feasible using SF6 with a CO2 amplifier at 10.0 micrometer and Xe with Xe at 3.5 micrometer. The use of the latter is recommended for the experimental test of the BALAD receiver. Two compact absorber configurations have been considered and will be further investigated. Application is to optical radar and to optical communications where signal direction is uncertain. (Author) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOMO7

AD- 747 967 20/5 17/5
UNITED AIRCRAFT RESEARCH LABS EAST HARTFORD CONN

Research Investigation of Picosecond and YAG
Laser Systems. (U)

DESCRIPTIVE NOTE: Annual technical rept. 1 Aug 71-31
Jul 72,
JUL 72 83P Glenn,W. H. ;Clobes,A.
R. ;
REPT. NO. UARL-L920479-36
CONTRACT: N00014-66-C-0344, ARPA Order-1806

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: See also report dated 25 Feb 71, AD-719 415.

DESCRIPTORS: (*LASERS, LIGHT PULSES), (*OPTICAL RADAR, RADAR IMAGES), INFRARED LASERS, FREQUENCY STABILIZERS, RESOLUTION (U)
IDENTIFIERS: *LASERS, *YTTRIUM ALUMINUM GARNET, *NEODYMIUM LASERS, STABILITY, DATA PROCESSING, IMAGE CONVERTERS, IMAGES (U)

The report discusses the investigation of the frequency stability characteristic of single-frequency Nd:YAG lasers, and of the use of coherent ultrashort pulses for high resolution imaging. Technical Results on the first topic include; the locking of a single-frequency Nd:YAG laser to the bandpass of a high finesse Fabry-Perot interferometer; the use of etalon thermal tuning of the laser for course frequency control; the construction of a second single-frequency laser; and the heterodyning of the two single-frequency YAG lasers at a variable frequency offset. In the area of high resolution imaging, a discussion of the application of microwave synthetic aperture techniques to optical radar is presented as are initial results of an experiment to obtain high optical resolution by doppler processing. (Author) (U)

AD- 747 003 20/5 17/8 17/5
ARMY FOREIGN SCIENCE AND TECHNOLOGY CENTER CHARLOTTESVILLE VA

Laser Locating Devices, (U)

JUN 72 88P Petrovskii,V. I. ;Pozhidaev, O. A. ;
REPT. NO. FSTC-HT-23-943-71
PROJ: FSTC-T7023012301

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: Trans. of unidentified Russian mono., Moscow, 1969, by Albert L. Peabody.

DESCRIPTORS: (*LASERS, REVIEWS), (*OPTICAL TRACKING, LASERS), (*OPTICAL RADAR, REVIEWS), RANGE FINDING, DISTANCE MEASURING EQUIPMENT, ALTIMETERS, SATELLITE TRACKING SYSTEMS, LIGHT HOMING, TARGET ACQUISITION, GAS LASERS, INFRARED LASERS, USSR (U)
IDENTIFIERS: RUBY LASERS, GALLIUM ARSENIDES, LASERS, HELIUM NEON LASERS, TRANSLATIONS (U)

The authors describe the principles upon which laser locating devices operate. They describe the materials used as lasers, and the methods which can be employed to modulate the laser beam. They discuss the use of lasers in locating systems for determining range, angular coordinates, and contour of a target object, and for tracking such objects after search has concluded. The examples of operating lasers which they cite specifically and the suggestions for future development of laser technology to which they refer are all taken from American publications. (Author) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOMO7

AD- 746 280 13/2 17/8 17/5
TORONTO UNIV (ONTARIO) INST FOR AEROSPACE STUDIES

A Comparative Study of Laser Methods of Air Pollution Mapping, (U)

DEC 71 44P Measures,R. M. ;
REPT. NO. UTIAS-174

UNCLASSIFIED REPORT

DESCRIPTORS: (*AIR POLLUTION, *OPTICAL RADAR), (*GAS DETECTORS, OPTICAL RADAR), (*NITROGEN OXIDES, GAS DETECTORS), GAS LASERS, SCATTERING, FLUORESCENCE, EXCITATION, BACKSCATTERING, RAMAN SPECTROSCOPY, MAPPING, ABSORPTION, MONITORS, RELAXATION TIME, CONCENTRATION(CHEMISTRY), MATHEMATICAL ANALYSIS, CANADA (U)
IDENTIFIERS: LASER INDUCED FLUORESCENCE, NITROGEN OXIDE(NO2), OPTICAL RADAR, *AIR POLLUTION DETECTION, PLUMES, LIGHT SCATTERING, RAMAN SPECTRA, TRACE ELEMENTS (U)

A comparative study has been made of three laser methods of remotely mapping gaseous pollutants of the atmosphere. It has been found that, in the case of NO2 and SO2, Differential Absorption and Scattering has superior performance potential with regard to range and sensitivity than either Laser-Induced Fluorescence or Raman Backscattering. However, because of the sophistication of this system and the difficulty of interpretation, it is strongly recommended that from the long term point of view the fluorescence approach be pursued further as it has a range and sensitivity far superior to Raman backscattering for a given laser power. An analysis of the fluorescence return expected from a local source of NO2 indicates that a plume of about 10 ppm could be detected at a range of several kilometers. However, due to absorption effects, care must be used in the interpretation of signals emanating from local concentrations in excess of about 10 ppm. (Author) (U)

AD- 745 543 20/5
PENNSYLVANIA STATE UNIV UNIVERSITY PARK DEPT OF ELECTRICAL ENGINEERING.

Simulation of Superposed Coherent and Chaotic Radiation of Arbitrary Spectral Shape, (U)

AUG 71 10P Ruggieri,Neil F. ;Cummings, Derald O. ;Lachs,Gerard ;
CONTRACT: DAHC04-70-C-0056, NASA-39-009-096
MONITOR: AROD 8936:3-E

UNCLASSIFIED REPORT

Availability: Pub. in Jnl. Applied Physics, v43 n3 p1118-1125 Mar 72.
SUPPLEMENTARY NOTE: Prepared in cooperation with C-Cor Electronics, Inc., State College, Pa.

DESCRIPTORS: (*COHERENT RADIATION, SIMULATION), (*OPTICAL COMMUNICATIONS, SIGNAL-TO-NOISE RATIO), (*OPTICAL RADAR, SIGNAL-TO-NOISE RATIO), GAS LASERS, BACKGROUND, PHOTONS, COUNTING METHODS (U)
IDENTIFIERS: *LASER BEAMS (U)

A simulation technique is described and used to generate superposed coherent and chaotic (thermal) radiation of arbitrary spectral shape. The statistical properties of a simulated radiation field with a Lorentzian spectral density is inevestigated with a photoelectron counting experiment. The experimental photocount distribution and normalized mth-order factorial moments are compared to theory and verify that the simulated radiation field, an appropriately modulated laser beam, has the expected statistical properties. The concept described indicates that one may, in prinicple, generate a thermal source of comparable intensity to that a laser, arbitrary spectral shape, and bandwidth. (Author) (U)

AD- 745 391 20/6 17/8
AIR FORCE WEAPONS LAB KIRTLAND AFB N MEX

The Far-Field Pattern of a Parallel-Staged MOPA(Master Oscillator Power Amplifier) Configuration. (U)

DESCRIPTIVE NOTE: Technical rept. Jan-Mar 72,
JUL 72 40P Love,John A. , III;
REPT. NO. AFWL-TR-72-117
PROJ: AF-3326CH
TASK: 3326CH05

UNCLASSIFIED REPORT

DESCRIPTORS: (*COHERENT RADIATION, DIFFRACTION), (*OPTICAL RADAR, MATHEMATICAL ANALYSIS), FOURIER ANALYSIS, PERFORMANCE(ENGINEERING), POWER AMPLIFIERS, RADAR TRANSMITTERS (U)
IDENTIFIERS: MASTER OSCILLATOR POWER AMPLIFIERS, MOPA(MASTER OSCILLATOR POWER AMPLIFIER), FAR FIELD (U)

The diffraction of coherent light by two circular apertures arranged in the shape of a 'Figure 8' is considered. The far-field or focal plane irradiance patterns are calculated and integrated over circular areas. The results are displayed in graphical form using dimensionless coordinates which are functions of the aperture size as well as the amplitude and phase distortions present in the radiation illuminating the aperture. Five cases which represent physically meaningful amplitude and phase profiles in the illuminating light are treated analytically. (Author) (U)

AD- 742 359 1/2 17/8
STANFORD RESEARCH INST MENLO PARK CALIF

Slant Range Visibility Measurement for Aircraft Landing Operations. (U)

DESCRIPTIVE NOTE: Final rept. 1 Apr 71-30 Apr 72,
FEB 72 94P Viegee,William ;Oblanas,John ;Collis,Ronald T. H. ;
CONTRACT: F19628-71-C-0152
PROJ: SRI-1148, AF-6670
TASK: 667004
MONITOR: AFCRL 72-0154

UNCLASSIFIED REPORT

DESCRIPTORS: (*AIRCRAFT LANDINGS, VISIBILITY), (*OPTICAL RADAR, AIRCRAFT LANDINGS), ALL WEATHER AVIATION, FOG, CLOUDS, INSTRUMENTATION, DATA PROCESSING (U)

A method of determining 'slant visibility' by lidar observations from the ground during various degrees of fog and low cloud conditions was investigated in an experimental program at a coastal site. The emphasis of the study was on the operational aspects of landing aircraft in Categories I and II conditons, and the first concern was to ascertain whether a pilot might be expected to obtain visual reference from the critical heights of 200 ft and 100 ft respectively. This depends primarily upon the transmittance along the slant path from the cockpit to the ground. The air of the lidar observations was to determine the conditions of atmospheric transmittance aloft, with special reference to whether the appropriate minimum values are exceeded. (Author) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOMO7

AD- 741 875 4/2 17/8
UNIVERSITY OF THE WEST INDIES KINGSTON (JAMAICA) DEPT OF PHYSICS

A Study of the Feasibility of Measuring Atmospheric Densities by Using a Laser-Searchlight Technique. (U)

DESCRIPTIVE NOTE: Final rept. 1 Apr 64-30 Jun 71,
FEB 72 76P Kent,G. S. ;Keenliside,W. ;Sandford,M. C. W. ;Ottway,M. ;Wright,R. W. H. ;
CONTRACT: AF-AFOSR-616-67
PROJ: AF-6682
TASK: 668207
MONITOR: AFCRL 72-0167

UNCLASSIFIED REPORT

DESCRIPTORS: (*ATMOSPHERIC SOUNDING, *OPTICAL RADAR), (*UPPER ATMOSPHERE, DENSITY), LASERS, LIGHT TRANSMISSION, BACKSCATTERING, ATMOSPHERIC MOTION, SYSTEMS ENGINEERING, RELIABILITY, PERFORMANCE(ENGINEERING), JAMAICA (U)
IDENTIFIERS: *ATMOSPHERIC DENSITY, REMOTE SENSING (U)

The report summarizes the work done during the period between April 1964 and June 1971 in developing and testing a laser radar technique to obtain backscattered signals from the atmosphere at altitudes up to 100 km. A vertically directed pulsed ruby laser signal with a 10 joule, 10 microsecond pulse provided the transmitted energy and an array of 30 inch diameter spherical mirrors provided a mirror area of 15 square meters to collect the backscattered energy. Photon counting techniques were utilized for high altitude returns and many returns are integrated to provide high sensitivity and to reduce the variance of the signals. (Author) (U)

AD- 741 324 17/8
PENNSYLVANIA STATE UNIV UNIVERSITY PARK

Detection Statistics for a Pulsed Laser Radar, (U)

MAY 71 6P Schell,John A. ;Lachs, Gerard ;
CONTRACT: DA-31-124-ARO(D)-383
PROJ: DA-2-0-061102-B-31-E
MONITOR: AROD 5659:10-E

UNCLASSIFIED REPORT

Availability: Pub. in IEEE Transactions on Aerospace and Electronic Systems, p1207-1210 Nov 71.
SUPPLEMENTARY NOTE: Revision of report dated 16 Feb 71.

DESCRIPTORS: (*OPTICAL RADAR, TARGET ACQUISITION), LASERS, PHOTONS, COUNTING METHODS, SIGNAL-TO-NOISE RATIO, PROBABILITY (U)

Photocount distributions for a narrow-band laser receiver in thermal background radiation are developed in a parallel sense to the envelope density functions for radio frequency radar. While classical detection performance is dependent on received signal-to-noise, the results show that narrow-band photocount detection additionally depends on the absolute levels of the received signal and noise. (Author) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOMO7

AD- 740 489 17/8 4/1
STANFORD RESEARCH INST MENLO PARK CALIF

SRI Dye-Laser-Radar Operation for Secede II. (U)

DESCRIPTIVE NOTE: Final technical rept.,
JAN 72 31P Long,Roy A. ;
CONTRACT: F30602-71-C-0154, ARPA Order-1057
PROJ: ARPA-0E20, SRI-1001
MONITOR: RADC TR-72-31

UNCLASSIFIED REPORT

DESCRIPTORS: (*ATMOSPHERIC SOUNDING, *OPTICAL RADAR), CONCENTRATION(CHEMISTRY), BARIUM, LASERS, DESIGN, TEST METHODS, DYES, BACKSCATTERING, RESOLUTION, FLORIDA (U)
IDENTIFIERS: *ORGANIC DYE LASERS, BARIUM CLOUDS, *CHEMICAL RELEASE STUDIES, SECEDE 2 PROJECT (U)

A dye laser radar (lidar) was operated at a site near Wewahitchka, Florida during the SECEDE II test series, in an attempt to measure barium-ion-density variations within the ion cloud. If present at all, barium ions occur in the natural atmosphere at concentrations much too low to provide resonance backscatter for system-performance evaluation. Therefore, the system was operated before shipment at a 5896-A sodium resonance line and adequate system performance was obtained. The results of the tests are given. (Author) (U)

AD- 738 372   4/2
STANFORD RESEARCH INST MENLO PARK CALIF

Lidar Observations of Sierra-Wave Conditions, (U)

JAN 68   7P   Collis,R. T. H. ;Fernald, F. G. ;Alder,J. E. ;

UNCLASSIFIED REPORT
Availability: Pub. in Jnl. of Applied Meteorology, v7 n2 p227-233 Apr 68.
SUPPLEMENTARY NOTE: Sponsored in part by Naval Air Systems Command, Washington, D. C. and White Sands Missile Range, N. Mex.

DESCRIPTORS: (*ATMOSPHERIC MOTION, MOUNTAINS), (*CLOUDS, ATMOSPHERIC MOTION), METEOROLOGICAL RADAR, OPTICAL RADAR, CLEAR AIR TURBULENCE, CALIFORNIA (U)
IDENTIFIERS: LASERS, OPTICAL RADAR, RUBY LASERS (U)

Early in 1967 a series of observations using pulsed ruby lidars were made near Independence, Calif.; the objective was to investigate the value of lidar for studying air motion in the Sierra wave, with special reference to indications of turbulence. Although no intense wave activity occurred, appreciable wave motions were observed, both in what appeared to the eye to be clear air and in air where the particulate matter was sufficiently concentrated as to be visible as clouds. Interruptions in the smooth laminar flow in the clear air were observed, and measurements were made of the length, amplitude and height of waves shown by clouds. With previoucly existing techniques, only limited observation of such phenomena have been possible. It is thus concluded that lidar observations are of considerable value in studying wave motion, even in the absence of visible clouds. There is also a possiblity that lidar could indicate the presence of turbulence by revealing the breakdown of wave motion or the presence of rotors. (Author) (U)

AD- 735 659   18/3
STANFORD RESEARCH INST MENLO PARK CALIF

Project Pre-Gondola I: Lidar Observations
of the Pre-Gondola I Clouds. (U)

DESCRIPTIVE NOTE: Final rept.,
JAN 67   82P   Oblanas,John W. ;Collis,
Ronald T. H. ;
CONTRACT: AT(04-3)-115
PROJ: SRI-6268
MONITOR: PNE 1110

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: Report on Plowshare- Civil,
Industrial and Scientific Uses for Nuclear
Explosives.

DESCRIPTORS: (*CLOUDS, *OPTICAL SCANNING), (*NUCLEAR EXPLOSIONS, *CRATERING), SIMULATION, EXPLOSION EFFECTS, OPDAR, SURFACE BURST, CLOUD COVER, DRIFT, OPTICAL TRACKING, INSTRUMENTATION (U)
IDENTIFIERS: LASER RADAR, CLOUD TRACKING, PLOWSHARE OPERATION, PRE-GONDOLA 1 OPERATION (U)

The report describes lidar (laser radar) observations of the dust and steam clouds that resulted from the Pre-GONDOLA I series of four chemical explosions made near Fort Peck Reservoir, Montana, during October-November 1966. The neodymium lidar was well able to track the clouds even when they became too tenuous to be seen visually or photographed. Observational data were analyzed to obtain cloud dimension, height, volume, rate of growth, volume backscatter coefficient and relative density variations. (Author) (U)

AD- 735 656 18/3
CALIFORNIA UNIV LIVERMORE LAWRENCE RADIATION LAB

Project Pre-Gondola I: Cloud Development Studies. (U)

DESCRIPTIVE NOTE: Final rept.,
JUL 67 73P Day,Walter C. ;Rohrer, Robert F. ;
MONITOR: PNE 1108

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: Report on Plowshare- Civil, Industrial and Scientific Uses for Nuclear Explosives.

DESCRIPTORS: (*CLOUDS, *OPTICAL SCANNING), (*NUCLEAR EXPLOSIONS, *CRATERING), SIMULATION, EXPLOSION EFFECTS, OPDAR, CLOUD COVER, PHOTOGRAPHIC TECHNIQUES, DRIFT, OPTICAL TRACKING, TRACER STUDIES (U)
IDENTIFIERS: LASER RADAR, CLOUD TRACKING, PLOWSHARE OPERATION, PRE-GONDOLA 1 OPERATION (U)

The clouds resulting from four 20-ton nitromethane cratering explosions in a wet clay shale medium were studied by photographic analysis and lidar (laser-radar) tracking. A technique for detecting tracers in future events in the same medium was investigated. (Author) (U)

[illegible] CENTER GRIFFISS AFB N Y

[illegible] Caused by Thermally [illegible] (U)

[illegible] Technical rept., [illegible] Ogrodnik,Robert F. ;

UNCLASSIFIED REPORT

[illegible] DEFORMATION), (*OPDAR, MIRRORS), [illegible] COHERENT RADIATION, IRASERS, [illegible] SIGNAL-TO-NOISE RATIO, BRASS, ALUMINUM, [illegible] ALLOYS (U)
[illegible] LASER RADAR, CARBON DIOXIDE LASERS, [illegible] (U)

[illegible] can seriously hamper coherent [illegible] employed in laser radar, especially [illegible] These distortions [illegible] by reducing the heterodyne [illegible] detection due to the [illegible] mismatch between signal and [illegible] oscillator. This study analyzes [illegible] distortions which occur when [illegible] is heated by intense, Gaussian [illegible] radiation. These distortions are [illegible] the body strains brought about [illegible] and radial temperature gradients [illegible] the mirror. Conditions affecting [illegible] are then determined by [illegible] the effects of base cooling on the radial [illegible] throughout the thickness of the [illegible] These results are applied to the metals [illegible] aluminum, copper and silver in an [illegible] the metal and cooling conditions [illegible] distortions over a wide [illegible] laser power levels and power [illegible] (Author) (U)

AD- 734 415 8/10 17/8
TEXAS A AND M UNIV COLLEGE STATION DEPT OF PHYSICS

Research Conducted through the Texas A and M Research Foundation. (U)

DESCRIPTIVE NOTE: Final rept. 15 Dec 70-15 Dec 71,
DEC 71 7P Plass,Gilbert N. ;Kattawar, George W. ;
REPT. NO. A/M-Ref-71-28T
CONTRACT: N00014-68-A-0308-0002
PROJ: NE-083-036, A/M-700-16

UNCLASSIFIED REPORT

DESCRIPTORS: (*OCEANOGRAPHIC EQUIPMENT, OPDAR), (*OCEANS, OPTICAL PROPERTIES), SURFACE PROPERTIES, COHERENT RADIATION, RAYLEIGH SCATTERING, ABSORPTION, REFRACTION, UNDERWATER OBJECT LOCATORS, REVIEWS (U)

Research is reported on the following topics: multiple scattering of light from a laser beam in the ocean; Variation of the radiance in the ocean as a function of wavelength, variations in the turbidity of the ocean, and the zenith angle of the sun; Effect of various wave slope distributions on the radiance within the ocean and above the ocean; and Polarization of the radiation within the ocean. (Author) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOM07

AD- [illegible] 4/2 17/8
NEW YORK UNIV BRONX GEOPHYSICAL SCIENCES LAB

Optical Probing of the Atmosphere. (U)

DESCRIPTIVE NOTE: Final rept. 1 Apr 70-30 May 71,
DEC 71 28P Schotland,Richard M. ;
REPT. NO. GSL-TR-71-12
CONTRACT: DAAB07-70-C-0142
PROJECT: [illegible] 0142-F

UNCLASSIFIED REPORT

DESCRIPTORS: (*CLOUDS, OPTICAL PROPERTIES), (ATMOSPHERIC SOUNDING, CLOUDS), (*OPDAR, SIGNAL-TO-NOISE RATIO), CIRRUS CLOUDS, CUMULUS CLOUDS, STRATUS CLOUDS, POWER SPECTRA, RADIOMETERS, CALIBRATION (U)
IDENTIFIERS: OPTICAL RADAR, ALTOSTRATUS CLOUDS, CLOUD PHYSICS, RADIANCE, REMOTE SENSING (U)

An investigation has been performed of the fluctuations of cloud radiance at 5400A as a function of cloud type and field of view of the receiving system. The fluctuations are observed to increase with nonuniformity of cloud structure and also with decreasing field of view. The ratio of the root mean square fluctuations of the cloud radiance to the mean value of the radiance was generally less than .005. Power spectra of the fluctuations are presented for cirrus, cumulus and altostratus cloud types. (Author) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOM07

AD- 733 345 17/8 17/5
ROME AIR DEVELOPMENT CENTER GRIFFISS AFB N Y

Laser Radar Cross-Section and Reflectivity Measurements at .48, .63, and 10.6 microns. (U)

DESCRIPTIVE NOTE: Technical rept.,
NOV 71 44P Demma,Fred J. ;Michels, James H. ;
REPT. NO. RADC-TR-71-245

UNCLASSIFIED REPORT

DESCRIPTORS: (*OPDAR, TARGET RECOGNITION), RADAR TARGETS, RADAR REFLECTIONS, TARGET DISCRIMINATION, SURFACE PROPERTIES, IRASERS (U)

The effect of target surface and shape, on the power reflected from it, as a function of aspect angle theta, has been investigated at 0.48, 0.63, and 10.6 micrometer in a laboratory environment. In particular, at 0.48 micrometer the reflected wave amplitude was measured relative to a standard cross *section target, a Lambertian Reflector*. This enabled the determination of actual Laser Radar Cross Section (LRCS) values for these targets. Further, the experimental results obtained were found to agree closely with analytical predictions based on specular scattering theory. (Author) (U)

AD- [illegible] 4/1 17/8
[illegible] COLLEGE PARK DEPT OF PHYSICS AND [illegible]

[illegible] Detection of Backscattering [illegible] Atmosphere (75-160 km), (U)

[illegible] 3P McCormick,P. D. ;Poultney, [illegible] ;Alley,C. O. ;Perschy, [illegible]
CONTRACT: [illegible] Cwb-WBG-4-FY-64
MONITOR: [illegible] 7027:12-P

UNCLASSIFIED REPORT
Availability: Pub. in Nature, v209 n5025 p798-799, [illegible]
SUPPLEMENTARY NOTE: Prepared in cooperation with Johns [illegible], Silver Springs, Md. Applied [illegible] Sponsored in part by Contract NObsr- [illegible], and Grant NGR-21-002-022.

DESCRIPTORS: (*UPPER ATMOSPHERE, RADAR REFLECTIONS), [illegible] RADAR REFLECTIONS), BACKSCATTERING, METEORS, [illegible] (U)
IDENTIFIERS: LIGHT SCATTERING, *ATMOSPHERIC [illegible], RUBY LASERS (U)

[illegible] radar system has recently been used to [illegible] backscattering from the upper [illegible] (75-160 km). Although a much more [illegible] investigation is in progress, our [illegible] results seem to indicate rough agreement [illegible] of Fiocco and Smullin. These [illegible] suggested micrometeorites as a source of the [illegible] (Author) (U)

AD- 732 811 17/8 4/1
MARYLAND UNIV COLLEGE PARK DEPT OF PHYSICS AND ASTRONOMY

Optical Radar Detection of Backscattering from the Upper Atmosphere, (U)

AUG 67 4P McCormick,P. D. ; Silverberg,E. C. ;Poultney,S. K. ;Van Wijik,U. ;Alley,C. O. ;
CONTRACT: DAHC04-67-C-0023
MONITOR: AROD 7027:13-P

UNCLASSIFIED REPORT
Availability: Pub. in Nature, v215 n5107 p1262-1263, 16 Sep 67.
SUPPLEMENTARY NOTE: Revision of report dated 9 Jun 67.

DESCRIPTORS: (*OPDAR, RADAR REFLECTIONS), UPPER ATMOSPHERE, BACKSCATTERING, LASERS (U)
IDENTIFIERS: *LASER RADAR, RUBY LASERS (U)

A previous communication reported preliminary observations of atmospheric backscattering obtained with an optical radar system at the University of Maryland. The purpose of this communication is to report some of our recent results which indicate enhanced scattering near 80 km, to describe some improvements made in our equipment which have eliminated the high background noise that was evident in our earlier data and to comment on the remarks of Bain and Sandford pertaining to these data. (Author) (U)

AD- 732 809 20/6 4/1 17/8
MARYLAND UNIV COLLEGE PARK

Laser Scatter Measurements in the Mesosphere and Above. (U)

APR 68 2P Silverberg,E. C. ;Poultney, S. K. ;Bettinger,R. T. ;Alley,C. O. ; McCormick,Paul D. ;
CONTRACT: DAHC04-67-C-0023
MONITOR: AROD 7027:9-P

UNCLASSIFIED REPORT
Availability: Pub. in Jnl. of Atomospheric and Terrestrial Physics, v31 p185-186 1969.
SUPPLEMENTARY NOTE: Prepared in cooperation with Mount Haleakala Observatory, Hawaii.

DESCRIPTORS: (*LIGHT TRANSMISSION, *ATMOSPHERIC SOUNDING), (*OPDAR, SCATTERING), AEROSOLS, SYSTEMS ENGINEERING, PERFORMANCE(ENGINEERING), MESOSPHERE (U)
IDENTIFIERS: LIGHT SCATTERING, RUBY LASERS (U)

Recent papers by Sandford are discussed in relation to results from an improved optical radar which was in use during the period January-February 1967. (Author) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOM07

AD- 731 860 4/1 17/8
AVCO EVERETT RESEARCH LAB EVERETT MASS

Secede Laser Radar Experiment. (U)

DESCRIPTIVE NOTE: Final technical rept.,
AUG 71 47P Itzkan,I. ;DeBaryshe,P. G. ;Kirk,R. A. ;
CONTRACT: F30602-71-C-0025, ARPA Order-1057
PROJ: ARPA 0E20
MONITOR: RADC TR-71-230

UNCLASSIFIED REPORT

DESCRIPTORS: (*ATMOSPHERIC SOUNDING, UPPER ATMOSPHERE), (*OPDAR, ATMOSPHERIC SOUNDING), ELECTRON DENSITY, DISTRIBUTION, LASERS, RADAR ECHO AREAS, BARIUM, DATA PROCESSING SYSTEMS, FEASIBILITY STUDIES (U)
IDENTIFIERS: BARIUM CLOUDS, *CHEMICAL RELEASE STUDIES, *SECEDE PROJECT (U)

In support of the SECEDE 2 barium release test series, AVCO-Everett Research lab. conducted an experiment to demonstrate the feasibility of making measurements of spatial density distribution in a barium ion cloud. The feasibility measurements were made with a laser radar breadboard which transmits laser pulses at the wavelengths of the 4934A ion ground state resonance line, and detects the return signals by means of a collecting telescope and photomultiplier, all mounted on an alt-azimuth platform. A videotape recorder was used to record the time resolved return signals, and a boresight camera was used to record pointing information. Provisions were included for control, display and field calibration of the system. Preliminary reductions and evaluation of a small fraction of the tape recorder data has been accomplished. (Author) (U)

AD- 731 736 17/9 17/8
GRUMMAN AEROSPACE CORP BETHPAGE N Y RESEARCH DEPT

Limitations Imposed on the Resolution of Coherent Radar Systems by Atmospheric Turbulence. (U)

DESCRIPTIVE NOTE: Research memo.,
OCT 71 40P Wohlers,M. R. ;
REPT. NO. RM-520
MONITOR: GIDEP 347.00.00.00-K4-143

UNCLASSIFIED REPORT

DESCRIPTORS: (*COHERENT RADAR, RESOLUTION), (*OPDAR, RESOLUTION), RADAR INTERFERENCE, ATMOSPHERIC MOTION, TURBULENCE, TARGET DISCRIMINATION (U)

The resolution of a radar system or its ability to produce images showing fine detail of a target is limited by various factors. On the one hand there are deterministic factors such as the size of the antenna used in the system, and on the other hand there are random or nondeterministic factors such as the noise in the receiving system or the turbulence of the atmosphere that distort the electromagnetic waves propagating to and from the target. Up to the present the limitation imposed on the resolution of the radar system by atmospheric turbulence has not been a matter of great concern as the effects are generally small when the frequency of operation of the radar is in the lower portions of the microwave spectrum. However, when one considers a millimeter wave or optical wave radar, then the effects of atmospheric turbulence can become the dominant or controlling factor. This memorandum attempts to indicate the magnitude of the problem by finding the limitations imposed by atmospheric turbulence on those radar systems that function by sensing the angle-of-arrival of the return signal from the target. (Author) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOM07

AD- 731 051 17/8 9/5 20/6
NAVAL RESEARCH LAB WASHINGTON D C

Application of a Scanned-Laser Active Imaging System to Atmospheric and Underwater Viewing Environments. (U)

DESCRIPTIVE NOTE: Interim rept.,
AUG 71 20P Waynant,Ronald W. ;
REPT. NO. NRL-7287
PROJ: NRL-N01-24, RR104-03-41

UNCLASSIFIED REPORT

DESCRIPTORS: (*OPDAR, RESOLUTION), (*COHERENT RADIATION, BACKSCATTERING), OPTICAL IMAGES, LASERS, UNDERWATER LIGHT, ATMOSPHERE, CATHODE RAY TUBE SCREENS, IMAGE INTENSIFIERS(ELECTRONICS) (U)

A scanned-laser active imaging system employing a synchronously scanned image-dissector detector was analyzed from the standpoint of how much resolution would be available to an observer viewing a CRT display. Graphical results are given of the system performance in atmospheric and underwater environments as well as of the effects of laser power, wavelength, and the addition of image intensifiers to the receiving system. The novelty of the analysis is that it directly predicts the detection performance of the human observer when aided by a scanned-laser active imaging system. The performance of such a system compares favorably with range-gated imaging systems. (Author) (U)

AD- 726 433 8/10 17/8
TEXAS A AND M UNIV COLLEGE STATION DEPT OF PHYSICS

Time of Flight Lidar Measurements as an Ocean Probe. (U)

DESCRIPTIVE NOTE: Technical rept. 15 Dec 70-1 Jul 71,
JUL 71 24P Kattawar,George W. ;Plass, Gilbert N. ;
REPT. NO. A/M-Ref-71-17T
CONTRACT: NC0014-68-A-0308-0002
PROJ: NE-083-036

UNCLASSIFIED REPORT

DESCRIPTORS: (*OCEANOGRAPHIC EQUIPMENT, OPTICAL RADAR), (*OCEANS, OPTICAL PROPERTIES), SURFACE PROPERTIES, COHERENT RADIATION, RAYLEIGH SCATTERING, ABSORPTION, REFRACTION, MONTE CARLO METHOD, UNDERWATER OBJECT LOCATORS (U)

Photons emitted by a narrow laser beam are followed through multiple scattering events in the ocean until registered by a detector at the source position. A realistic ocean model is used which takes account not only of molecular scattering (Rayleigh) and absorption, but also scattering and absorption by the hydrosols (Mie). The single scattering function for the hydrosols is calculated from Mie theory assuming a relative index of refraction of 1.15 and a size distribution with a modal radius of 3 micrometers. Targets with various surface albedos (A) are introduced at various distances from the source. The three dimensional path of the photons is followed by a Monte Carlo technique. When A = or > 0.02 the returned flux per unit photon path length from the targets is greater than the background from the laser beam for any target distance. The returned flux is plotted as a function of the photon path length. In practice the detection distance is limited by the lowest flux which can be detected and the background of natural light. Inhomogeneities in the optical properties of the ocean can also be measured in this way. (Author) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOMO7

AD- 721 253 17/8 20/5
ARMY FOREIGN SCIENCE AND TECHNOLOGY CENTER CHARLOTTESVILLE VA

Light Phase Range Finding and Modulation of Optical Radiation (Fazovaya Svetodalnometriya i Modulyatsiya Opticheskogo Izlucheniya), (U)

FEB 71 27P Adryanova,I. I. ;Vafyadi, V. G. ;Popov,Yu. V. ;
REPT. NO. FSTC-HT-23-062-71

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: Trans. from Optiko-Mekhanicheskaya Promyshlennost (USSR) n4 Apr 70.

DESCRIPTORS: (*OPTICAL RADAR, PERFORMANCE(ENGINEERING)), (*LASERS, *RANGE FINDING), OPTICAL EQUIPMENT, LIGHT TRANSMISSION, MODULATION, INFRARED LASERS, USSR (U)
IDENTIFIERS: *LASER RANGE FINDERS, RANGE FINDING, TRANSLATIONS (U)

Soviet development of optical radar by the State Optical Institute, culminating in the world's first range finder using propagation time of light, is discussed. The principles of this new branch of optical radar, known as light phase range finding, are examined in detail. The conclusion aims at obtaining greater effectiveness and efficiency through further development of pulse range finding. (Author) (U)

AD- 721 067 17/8
MASSACHUSETTS INST OF TECH LEXINGTON LINCOLN LAB

10.6 MICRON CO sub 2 Laser Radar. (U)

DESCRIPTIVE NOTE: Meeting speech article,
NOV 70 3P Gilmartin,Thomas J. ;
Bostick,Hoyt A. ;Sullivan,Leo J. ;
REPT. NO. MS-2944
CONTRACT: AF 19(628)-5167, ARPA Order-600
MONITOR: ESD TR-70-421

UNCLASSIFIED REPORT
Availability: Pub. in NEREM-70, p168-169.

DESCRIPTORS: (*OPTICAL RADAR, INFRARED LASERS), (*GAS LASERS, OPTICAL RADAR), CARBON DIOXIDE, INFRARED EQUIPMENT (U)
IDENTIFIERS: CARBON DIOXIDE LASERS (U)

The technology associated with 10.6 micron laser radar has advanced rapidly during the past several years. A brief account of this development as it relates to the high power laser radar system now in operation at M.I.T. Lincoln Laboratory is given, as is a description of the system itself. (Author) (U)

AD- 720 855 17/8 20/5
EG AND G INC BEDFORD MASS

On the Calibration, Accuracy, and Efficiency of Optical Range Finders. (U)

DESCRIPTIVE NOTE: Final rept. Mar-Jun 70,
JUL 70 106P Ackerman,Sumner ;
REPT. NO. EG/G-B-4248
CONTRACT: F19628-70-C-0200
PROJ: AF-7600
TASK: 760006
MONITOR: AFCRL 71-0021

UNCLASSIFIED REPORT

DESCRIPTORS: (*OPTICAL RADAR, PERFORMANCE(ENGINEERING)), (*LASERS, RANGE FINDING), PHOTOELECTRIC EFFECT, SIGNAL-TO-NOISE RATIO, CALIBRATION, EFFICIENCY, RELIABILITY(ELECTRONICS), TEST METHODS, COMPUTER PROGRAMS (U)
IDENTIFIERS: *LASER RANGE FINDERS, RANGE FINDING (U)

A theory has been developed concerning the calibration, random errors, and efficiency of optical range finders as a function of signal energy; the magnitude of background noise is treated as a parameter. Efficiency is defined herein as the amount of information obtained on the location of the target within the transmitter-pulse period per range measurement trial per unit of signal energy used. Poisson and Bose-Einstein photoemission statistics were assumed. Experimental measurements are generally in good agreement with theoretical predictions. (Author) (U)

AD- 720 351 17/8
NAVAL WEAPONS LAB DAHLGREN VA

The Naval Weapons Laboratory Laser Ranger/Tracker System. (U)

DESCRIPTIVE NOTE: Technical rept.,
NOV 70 52P Harold,N. Norbert ;
REPT. NO. NWL-TR-2469

UNCLASSIFIED REPORT

DESCRIPTORS: (*OPTICAL RADAR, PERFORMANCE(ENGINEERING)), (*GUIDED MISSILE TRACKING SYSTEMS, *LASERS), MOBILE, ROCKETS, OPTICAL TRACKING, SAFETY (U)

A working breadboard model of a laser-based missile tracking and ranging system was designed and developed. The system was evaluated under actual rnge conditions where it was demonstrated its capabilities in tracking 2.75- and 5-inch rockets over the initial portion of their flights. The system is a self-contained mobile unit containing several subsystems. Each subsystem is an independent unit in that it can be modified to meet specific requirements without affecting other subsystems. Sufficient flexibility is inherent in the system to render it useful as a research tool or as a standard range instrumentation item. (Author) (U)

AD- 717 707 17/8 4/2
AIR FORCE WEAPONS LAB KIRTLAND AFB N MEX

A Ladar Cloud/Target Polarization Discrimination Technique. (U)

DESCRIPTIVE NOTE: Technical rept. Oct 64-Apr 70,
OCT 70 183P Manz,Joe E. ;
REPT. NO. AFWL-TR-70-76
PROJ: AF-5791
TASK: 579102

UNCLASSIFIED REPORT

DESCRIPTORS: (*OPTICAL RADAR, TARGET DISCRIMINATION), (*MONOCHROMATIC LIGHT, REFLECTION), (*CLOUDS, TARGET RECOGNITION), POLARIZATION, CLOUD CHAMBERS, SCATTERING, FOG, MATHEMATICAL ANALYSIS, LASERS, OPTICAL PROPERTIES, CLASSIFICATION, DROPS, AEROSOLS, THERMODYNAMICS, EQUATIONS OF STATE, TRANSMITTER RECEIVERS, SIGNAL-TO-NOISE RATIO (U)
IDENTIFIERS: LASER DETECTION AND RANGING, MIE SCATTERING, *LADAR(LASER DETECTION AND RANGING) (U)

The use of laser detection and ranging (ladar) systems in the atmosphere is limited by the severe attenuation of the signal due to absorption by atmospheric gases and/or scattering by cloud and fog particles. Furthermore, the cloud and fog particles may scatter the transmitted radiation toward the receiver, thus producing a false return, which must be distinguished from the true target return. Described herein is an optical polarization technique for discriminating between a cloud return and a target return. Also presented are the results of a research program which demonstrated the validity of the discrimination technique both in the laboratory and in the field. The conclusion is that the cloud/target discrimination technique will greatly improve the capability of a ladar system to distinguish between an atmospheric cloud and a target. (Author) (U)

AD- 717 693 17/8 8/5 20/5
AIR FORCE CAMBRIDGE RESEARCH LABS L G HANSCOM FIELD MASS

A Laser System for Satellite Geodesy. (U)

DESCRIPTIVE NOTE: Instrumentation papers,
NOV 70 18P Iliff,Robert L. ;
REPT. NO. AFCRL-70-0614, AFCRL-IP-168
PROJ: AF-7600
TASK: 760006

UNCLASSIFIED REPORT

DESCRIPTORS: (*OPTICAL RADAR, SATELLITE TRACKING SYSTEMS), (*LASERS, STEREOSCOPIC RANGE FINDING), TRIANGULATION, POSITION FINDING, GEODESICS (U)
IDENTIFIERS: *OPTICAL RADAR, Q SWITCHED LASERS, RUBY LASERS, GEODETIC SATELLITES, *GEODESY (U)

A noval laser system designed and developed for satellite illumination is based on the use of two ruby lasers. It obtains range with a Q-switched laser and angular information by photographing satellite-reflected high-energy normal-mode laser pulses against stellar fields. The Q-switched laser system, operated in a controlled multipulse mode, is capable of up to 10 range measurements in a single pumping period. This increases confidence in the validity of the measurements especially since they are obtained in the presence of the high background noise that is encountered in daylight range measurements. The difference in satellite range within a 400-microsec time frame has been observed by means of the multipulse approach. (Author) (U)

AD- 716 483 4/1 1/2
STANFORD RESEARCH INST MENLO PARK CALIF

Visibility Measurement for Aircraft Landing Operations. (U)

DESCRIPTIVE NOTE: Final rept. 26 Sep 69-30 Sep 70,
SEP 70 148P Collis,Ronald T. H. ;
Viezee,William ;Uthe,Edward E. ;Oblanas,John
;
CONTRACT: F19628-70-C-0083, DOT-FA70WAI-178
PROJ: AF-6670, SRI-8301
TASK: 667004
MONITOR: AFCRL 70-0598

UNCLASSIFIED REPORT

DESCRIPTORS: (*ATMOSPHERES, VISIBILITY), (*VISIBILITY, *AIRCRAFT LANDINGS), OPTICAL RADAR, FOG, BACKSCATTERING, OPTICAL PROPERTIES, DETECTION, NEODYMIUM, RADAR REFLECTORS, MONITORS, ATTENUATION, TRANSMITTER RECEIVERS, SENSITIVITY, CEILING, CALIFORNIA (U)
IDENTIFIERS: *LIDAR(LIGHT DETECTION AND RANGING), *LIGHT DETECTION AND RANGING, AN/GMQ-10 (U)

An experimental pulsed neodymium lidar system was modified and calibrated to obtain accurate data on atmospheric extinction properties in fog and low cloud conditions. The objective was to establish the theoretical and practical basis of a system for measuring slant visibility conditions for aircraft landing operations. To operate in conditions of fog and low cloud the lidar system's dynamic range was extended to 50 dB by using a two-stage receiver system. In addition, the transmitter and receiver beams were made coaxial to make close-range observations. (Author) (U)

AD- 715 550 4/1
GENERAL ELECTRIC CO PHILADELPHIA PA MISSILE AND SPACE DIV

Determination of Atmospheric Transmissivity from Laser Backscatter Measurements, (U)

66 50P Halsey,H. W. ;Gray,E. L.
;
REPT. NO. R66SD44, Reprint-448

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: Sponsored in part by U. S. Air Force.

DESCRIPTORS: (*ATMOSPHERIC SOUNDING, OPTICAL RADAR), (*LIGHT TRANSMISSION, ATMOSPHERES), ATMOSPHERIC REFRACTION, ATTENUATION, PHOTOMETERS, INFRARED LASERS, BACKSCATTERING, STARS (U)
IDENTIFIERS: RUBY LASERS, TRANSMISSIVITY (U)

In the paper single ended and double telephotometers are analyzed in the light of the Mie theory for the scattering of light by isotropic spherical particles. It is shown that the double ended telephotometer has an inherent possibility of error when used to measure atmospheric transmissivity. The single ended telephotometer, on the other hand, offers the optimum technique for obtaining an error free measurement. The analysis of the single ended device is expanded and by deriving a relationship between the transmissivity the intensity of light backscattered from the atmosphere and the elements of the scattering matrix, it is shown that the atmospheric transmissivity can be predicted by examining the backscattered light from a pulsed light source. An experiment is performed in which a Q-switched ruby laser is used as the light source and atmospheric transmissivity is obtained by measuring the backscattered light. These measurements are compared with simultaneous transmissivity measurements taken on stars by conventional methods. (Author) (U)

AD- 713 582 17/5 20/5
ARMY ELECTRONICS COMMAND FORT MONMOUTH N J ELECTRONIC COMPONENTS LAB

NEODYMIUM YAG LASER FOR OPTICAL RADAR APPLICATIONS, (U)

70 14P Strozyk,John W. ;Rosati, Vincent J. ;

UNCLASSIFIED REPORT

DESCRIPTORS: (*OPTICAL RADAR, SYSTEMS ENGINEERING), (*LASERS, PERFORMANCE(ENGINEERING)), DOPING, NEODYMIUM, YTTRIUM COMPOUNDS, ALUMINATES, TEST METHODS, FEASIBILITY STUDIES (U)
IDENTIFIERS: YTTRIUM ALUMINATES, YTTRIUM ALUMINUM GARNET, *LASERS, *YTTRIUM ALUMINUM GARNET, *NB:YAG LASERS (U)

The development of the Nd:YAG laser resulted in a relatively simple Nd:YAG device with characteristics worthly of optical radar feasibility studies over short ranges, the results of which are presented here. The requirements includes the Nd:YAG laser as the transmitter, telescope optics for beam collimation, telescope optics to collect returning signals, a photomultiplier to process the signals and an oscilloscope to display the information. The design of each unit or component will be fixed by the laser characteristics and to some extent by the intended application (i.e. simple range data as compared to range rate data). The analysis or design of any radar system inevitably involves a radar range equation in one form or other. This approach is applicable to laser radars and has been used by many people under the assumption of having diffuse targets and constant atmospheric parameters. The results, which only approximations, are of acknowledged use and are developed here. (Author) (U)

AD- 707 810 17/5
MASSACHUSETTS INST OF TECH LEXINGTON LINCOLN LAB

EXPERIMENTS WITH A CO2 LASER RADAR SYSTEM. (U)

DESCRIPTIVE NOTE: Meeting speech,
68 7P Bostick,Hoyt A. ;
REPT. NO. MS-2350
CONTRACT: AF 19(628)-5167
MONITOR: ESD TR-70-157

UNCLASSIFIED REPORT
Availability: Pub. in Proceedings of the Annual SPIE Technical Symposium (13th), p351-356, 19 Aug 68.

DESCRIPTORS: (*OPTICAL RADAR, GAS LASERS), INFRARED LASERS, DOPPLER SYSTEMS, REFLECTION, OPTICAL TRACKING (U)
IDENTIFIERS: CARBON DIOXIDE LASERS (U)

Radar techniques can be used for determining several characteristics of remote objects, the principal ones being range, velocity, and reflection cross-section. Advances in laser technology now allow some of these techniques to be extended into previously inaccessable high frequency ranges, corresponding to infrared and optical wavelength regions. Shorter wavelengths, in principle, permit increased precision in spatial measurements as well as narrowing of transmitted beams. The program described here is concerned with velocity determinations through measurement of the Doppler frequency shifts and character of reflections from moving bodies. (Author) (U)

AD- 706 686 17/5
POLYTECHNIC INST OF BROOKLYN FARMINGDALE N Y DEPT OF ELECTROPHYSICS

A WIDE-ANGLE LOW-NOISE RECEIVER, (U)

70 4P Gould,Gordon ;
CONTRACT: F44620-69-C-0047
PROJ: AF-4751
MONITOR: AFOSR 70-1457TR

UNCLASSIFIED REPORT
Availability: Pub. in Laser Jnl., v2 n1 p19-20 Jan/Feb 70.

DESCRIPTORS: (*OPTICAL RADAR, *INFRARED DETECTORS), (*GAS LASERS, INFRARED RADIATION), (*COHERENT RADIATION, ATTENUATION), INFRARED LASERS (U)
IDENTIFIERS: CARBON DIOXIDE LASERS (U)

A saturable inhomogeneous gaseous absorber may be inserted between a laser amplifier and detector to filter out light which is not spatially, spectrally and temporally coherent with the focussed signal beam - an optical 'squelch.' The field of view is limited only by the amplifier tube. Calculations show this receiver is potentially superior to direct or heterodyne detection in IR systems. (Author) (U)

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OPTICAL RADAR. (U)
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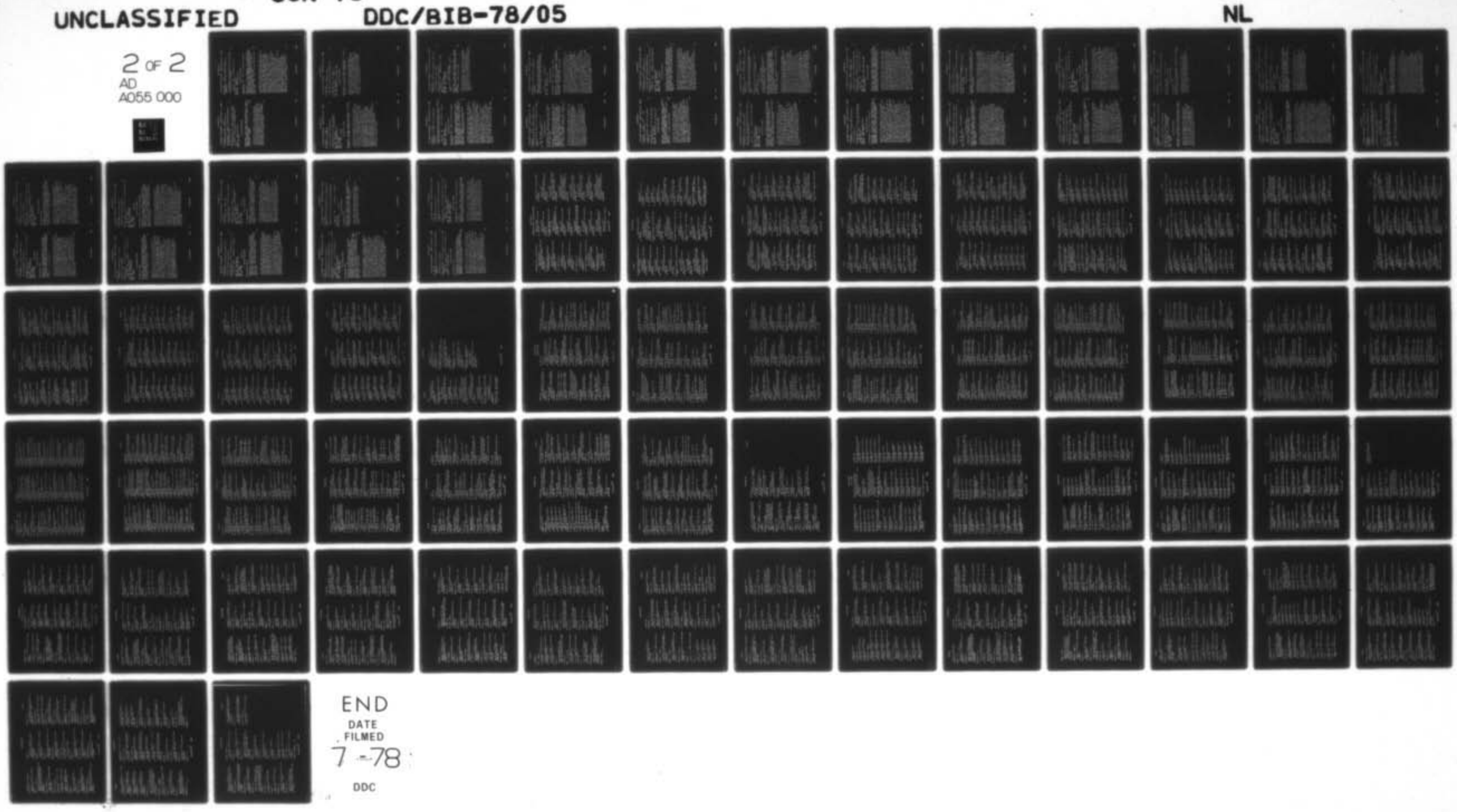

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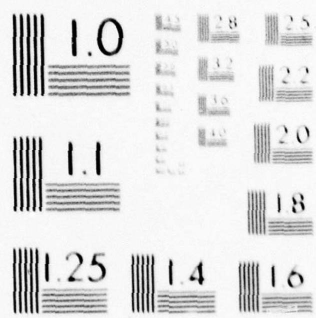

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AD- 701 416 8/10 17/8
STANFORD RESEARCH INST MENLO PARK CALIF

DEVELOPMENT OF A TURBIDITY-MEASURING UNDERWATER OPTICAL RADAR SYSTEM. (U)

DESCRIPTIVE NOTE: Final rept. 1 Jun 68-31 Aug 69,
DEC 69 72P Krishnan,Damala S. ;Evans, William E. ;Honey,Richard C. ;Sorenson,Glenn P.;
CONTRACT: N00014-68-C-0450
PROJ: SRI-7325

UNCLASSIFIED REPORT

DESCRIPTORS: (*SEA WATER, LIGHT TRANSMISSION), (*OPTICAL RADAR, UNDERWATER), LASERS, FEASIBILITY STUDIES, WAKE, PHOTOMULTIPLIER TUBES (U)
IDENTIFIERS: *TURBIDITY (U)

The results of a feasibility study of measuring subsurface turbidity in the ocean are presented. The design and development of the laser transmitter and receiver packages of an underwater optical radar system are discussed. The initial performance of the equipment in three field trials in the Pacific Ocean is described, the data obtained is discussed, and the system is evaluated. (Author) (U)

AD- 701 335 9/2 17/8 4/1
MICHIGAN UNIV ANN ARBOR INST OF SCIENCE AND TECHNOLOGY

AN ATMOSPHERIC LIDAR DATA-ACQUISITION SYSTEM USING AN ON-LINE DIGITAL COMPUTER, (U)

FEB 70 47P McCormick ,Paul D. ; Hultquist ,H. David ;
REPT. NO. 1386-29-T
CONTRACT: DAHC15-68-C-0144

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: Report of the Mount Haleakala Observatory.

DESCRIPTORS: (*UPPER ATMOSPHERE, LIGHT TRANSMISSION), (*OPTICAL RADAR, *DATA PROCESSING), COHERENT RADIATION, LASERS, BACKSCATTERING, PHOTOMULTIPLIER TUBES, PULSE AMPLIFIERS, PULSE HEIGHT ANALYZERS, INPUT OUTPUT DEVICES, COMPUTERS, REAL TIME (U)
IDENTIFIERS: OPTICAL RADAR, ON LINE COMPUTERS, DATA ACQUISITION (U)

The report describes the design and operation of a data-acquisition system which uses digital circuits and an on-line PDP-8/I computer for real-time data processing to make upper atmospheric LIDAR measurements. The system is presently being used with the high-power pulsed ruby laser which has recently been installed at the Mount Haleakala Observatory, Maui, Hawaii. The report discusses the basic concepts involved in obtaining LIDAR measurements of atmospheric backscattering. Expected signal returns for both the 'current' (lower atmosphere) and pulse-counting (upper atmosphere) cases are calculated. Noise and background sources are considered in detail, and the statistical nature of the upper atmospheric experiments is emphasized. Detailed circuit diagrams for the data acquisition system and a LIDAR data-acquisition program for the PDP-8/I computer are also included. Preliminary data obtained with the LIDAR system is presented and compared with prediction. (Author) (U)

AD- 700 094 17/8
EG AND G INC BEDFORD MASS

A STUDY OF OPTICAL RADAR DETECTION. (U)

DESCRIPTIVE NOTE: Final rept. Mar-Sep 69,
DEC 69 114P Ackerman,Sumner ;
REPT. NO. EG/G-B-4123
CONTRACT: F19628-69-C-0174
PROJ: AF-7600
TASK: 760006
MONITOR: AFCRL 69-0539

UNCLASSIFIED REPORT

DESCRIPTORS: (*OPTICAL RADAR, OPTIMIZATION), DETECTION, PHOTOMULTIPLIER TUBES, PROBABILITY, LASERS (U)

A theoretical and experimental study of optical energy detection shows that the optimal pulsed radar receiver, in the sense that detection probability is maximized for a given false-alarm probability and signal level, is one whose resolution time is equal to or greater than the transmitter pulse duration. This will be true for any likely statistical distributions of noise and signal energy. The statistics of photoelectron multiplication were obtained for a typical multiplier phototube by a combination of measurement and calculation. These were used to show that the 'ideal photoelectron counter' is usually, but not always, the best detector for pulsed optical radar. Exceptions at lower noise levels and/or relatively high false-alarm probabilities are due to the comparative inflexibility of threshold control of the photoelectron counter. (Author) (U)

AD- 699 519 17/8
NAVAL RESEARCH LAB WASHINGTON D C

LASER RADAR RANGE EQUATION CONSIDERATIONS. (U)

DESCRIPTIVE NOTE: Final rept.,
DEC 69 37P Wyman,P. W. ;
REPT. NO. NRL-6971
PROJ: NRL-R02-24A, RF-17-344-401-4509

UNCLASSIFIED REPORT

DESCRIPTORS: (*OPTICAL RADAR, RANGE(DISTANCE)), LASERS, EQUATIONS, REFLECTION, LIGHT TRANSMISSION (U)

Starting with basic physical and beam-target-geometry concepts, a generalized laser radar range equation is derived which holds for a target at any range in the far field. For completeness, the reflective properties of a target, its cross section, and the one-way atmospheric transmission loss are examined. The relationships derived in this report are general in that they are valid at any (e.g., microwave) wavelengths. (Author) (U)

AD- 698 494 17/8
MICHIGAN UNIV ANN ARBOR INST OF SCIENCE AND TECHNOLOGY

LASER RANGING TO THE SATELLITE GEOS A WITH THE MOUNT HALEAKALA OBSERVATORY LASER RANGING SYSTEM, (U)

DEC 69 32P McCormick,Paul D. ;Myers, Williard L. ;
REPT. NO. 1386-32-T
CONTRACT: DAHC15-68-C-0144

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: Report of the Mount Haleakala Observatory.

DESCRIPTORS: (*SATELLITE TRACKING SYSTEMS, *OPTICAL RADAR), RANGE FINDING, UPPER ATMOSPHERE, LASERS, REFLECTORS, MONITORS, RUBY, ASTRONOMICAL OBSERVATORIES, TRACKING TELESCOPES, SCIENTIFIC SATELLITES, ORBITS, HAWAII, TABLES(DATA) (U)
IDENTIFIERS: GEOS A SATELLITE, MOUNT HALEAKALA OBSERVATORY, RETROREFLECTOR SATELLITES (U)

The report describes a successful laser ranging experiment which was conducted on the retroreflector satellite GEOS A on 23 May 1969 at the Mount Haleakala Observatory, Maui, Hawaii. A total of 99 returns were obtained out of 113 laser firings during the sunlit portion of the satellite's pass. The returns were obtained from ranges of 2326 to 2937 km. The observed ranges are compared to predictions made by the Smithsonian Astrophysical Observatory, and it is found that the agreement is excellent. Acquisition and tracking techniques used during the ranging experiment are discussed. Photographs of the satellite and of an outgoing laser pulse (as seen on a television monitor) are presented. A brief description of the laser system and relevant Observatory support systems is also included along with some information on retroreflector satellites. (Author) (U)

AD- 697 224 17/8
MASSACHUSETTS INST OF TECH LEXINGTON LINCOLN LAB

AN AUTOTRACKING CO2 LASER RADAR. (U)

DESCRIPTIVE NOTE: Meeting speech,
AUG 67 4P Bostick,Hoyt A. ;Ross, Arthur H. ;
REPT. NO. MS-2071
CONTRACT: AF 19(628)-5167
MONITOR: ESD TR-69-322

UNCLASSIFIED REPORT

Availability: Pub. in Nerem Record, p72-73 1967.

DESCRIPTORS: (*GAS LASERS, OPTICAL RADAR), (*OPTICAL RADAR, *INFRARED TRACKING), CARBON DIOXIDE, DOPPLER SYSTEMS (U)
IDENTIFIERS: CARBON DIOXIDE LASERS (U)

Position and velocity data from moving objects are obtained by heterodyne detection of reflected 10.6 micrometer radiation from a CW carbon dioxide laser. Using a conically scanned beam, Doppler-shifted returns are synchronously detected to provide tracking error signals for driving a pointing mount. (Author) (U)

AD- 694 845   17/8   17/2   9/4
FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OHIO

SEPARATING OPTICAL SIGNALS IN THE PRESENCE OF RANDOM NOISE,   (U)

MAY 69   286P   Shestov,N. S. ;
REPT. NO. FTD-HT-23-947-68

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: Edited trans. of mono. Vydelenie Opticheskikh Signalov na Fone Sluchainykh Pomekh, Moscow, 1967 p1-347.

DESCRIPTORS: (*COMMUNICATION SYSTEMS, NOISE), OPTICAL RADAR, NOISE(RADAR), RADAR INTERFERENCE, OPTICAL COMMUNICATIONS, STATISTICAL ANALYSIS, MODULATION, SIGNAL-TO-NOISE RATIO, OPTICAL SCANNING, ULTRAVIOLET COMMUNICATIONS, ELECTROOPTICS, THERMAL RADIATION, INFORMATION THEORY, VIDEO FILTERS, RADAR RECEIVERS, PROBABILITY, DESIGN, USSR   (U)
IDENTIFIERS: MULTICHANNEL COMMUNICATION, *RANDOM NOISE, *SIGNAL PROCESSING, TRANSLATIONS, UTILIZATION (U)

This book is intended for students, engineers, and scientists dealing with problems of the detection of various kinds of radiated signals against a background of random interference. On the bases of statistical theory, the book discusses problems of optimum discrimination signals against a noise background. The case of optical (light and heat) signals is considered. Particular attention is given to an analysis of a system using modulation of radiant flux and scanning and to methods of achieving multichannel detection systems. The theoretical material is accompanied by a considerable number of examples and practical recommendations. (Author)   (U)

AD- 693 493   17/8   4/1   20/5
MICHIGAN UNIV ANN ARBOR INST OF SCIENCE AND TECHNOLOGY

REPORT OF THE MOUNT HALEAKALA OBSERVATORY: FLUORESCENCE AS A SOURCE OF NOISE IN Q-SWITCHED RUBY LASER ATMOSPHERIC BACKSCATTERING EXPERIMENTS,   (U)

SEP 69   22P   McCormick,P. ;
REPT. NO. 1386-7-T
CONTRACT: DAHC15-68-C-0144

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: Report on Project AMOS.

DESCRIPTORS: (*OPTICAL RADAR, LASERS), (*ATMOSPHERIC SOUNDING, *LASERS), RUBY, FLUORESCENCE, BACKSCATTERING, NOISE(RADIO), SHUTTERS(OPTICS)   (U)
IDENTIFIERS: Q SWITCHED LASERS, RUBY LASERS   (U)

Interpretation of the results of atmospheric backscattering experiments, when using a Q-switched ruby laser as the source of photons, requires consideration of several sources of noise in the statistical analysis. This report discusses the effects of directly backscattered ruby fluorescence in detail. It is found that, for an unshuttered system, fluorescence noise will be equal to the signal expected from altitudes above about 50-60 km (assuming only a molecular atmosphere). The 'crossover' altitude is lowered if aerosols are present. When a shutter is used as a fluorescence block, it is found that a spurious 'layer' structure may be produced--but only for shutter cutoff times of greater than about 375 microseconds. It is concluded that, for a properly designed optical radar system, ruby fluorescence will not be a significant source of spurious returns. In particular, it is concluded that this source will not explain the enhanced returns from altitudes of about 80 km observed by McCormick. (Author)   (U)

AD- 693 189 20/6 20/5 17/9
AUTONETICS ANAHEIM CALIF

DIGITAL FREQUENCY SHIFTER FOR 10.6 MICRON RADIATION. (U)

DESCRIPTIVE NOTE: Final rept. Mar 68-Aug 69.
AUG 69 108P
REPT. NO. C9-1641/501
CONTRACT: N00014-68-C-0193, ARPA Order-306

UNCLASSIFIED REPORT

DESCRIPTORS: (*RADAR TRACKING, GAS LASERS), (*INFRARED RADIATION, *FREQUENCY CONVERTERS), ELECTROOPTICS, GALLIUM ARSENIDES, GERMANIUM, DOPPLER EFFECT, ELECTROACOUSTIC TRANSDUCERS, OPTICAL RADAR, DIGITAL SYSTEMS (U)
IDENTIFIERS: *LASERS, *OPTICAL RADAR (U)

A theoretical and experimental study of frequency shifters for 10.6 microns is presented. Three different designs were considered. Two of these designs made use of the electro-optic effect in GaAs to obtain a single side band frequency shift. The third design utilized the acousto-optic properties of germanium. Bragg reflection and 60 percent conversion efficiency were obtained in this acoustic frequency shifter with an input power of 4.4 watts at 10 MHz. A design is presented for a digital frequency shifter which can produce discrete frequency shifts from -1.2 GHz to +1.2 GHz in 200 MHz steps. (Author) (U)

AD- 679 594 17/8 4/2
STANFORD RESEARCH INST MENLO PARK CALIF

LIDAR-RADAR LOWER ATMOSPHERIC OBSERVATIONS. (U)

DESCRIPTIVE NOTE: Final scientific rept. 16 Oct 67-15 Oct 68,
NOV 68 69P Vfezee,William ;Oblanas,John
;
CONTRACT: F19628-68-C-0021
PROJ: AF-6670, SRI-6903
TASK: 667002
MONITOR: AFCRL 68-0586

UNCLASSIFIED REPORT

DESCRIPTORS: (*OPTICAL RADAR, *ATMOSPHERIC SOUNDING), SOUNDING ROCKETS, RADIOSONDES, RADAR CROSS SECTIONS, DIURNAL VARIATIONS, AIR POLLUTION, INSTRUMENTATION, K BAND, GROUND SUPPORT EQUIPMENT, STATISTICAL ANALYSIS (U)
IDENTIFIERS: OPTICAL RADAR, LIDAR(LIGHT DETECTION AND RANGING) (U)

Daytime observations of the vertical temperature and humidity structure in the atmosphere below 1000 meters made with a Cricketsonde rocket system are compared with simultaneous observations from a ruby lidar (laser radar) and a microwave K-band radar. Observations were made at the SRI field site in Palo Alto, California, during August 1968 in the absence of low clouds when haze and pollution were visually evident. Analyses of the data show a direct relationship between Cricketsonde and lidar data, an indirect relationship between Cricketsonde and K-band data, and no relationship between lidar data and K-band radar data. (Author) (U)

AD- 678 103 1/2 4/2 17/8
STANFORD RESEARCH INST MENLO PARK CALIF

ANALYSIS OF LIDAR DATA OBTAINED UNDER CONDITIONS OF LOW CEILING AND VISIBILITY, (U)

AUG 68 40P Viezee,William ;Uthe,Edward E. ;
REPT. NO. Scientific-1
CONTRACT: F19628-68-C-0021
PROJ: AF-6670, SRI-6903
TASK: 667002
MONITOR: AFCRL 68-0522

UNCLASSIFIED REPORT

DESCRIPTORS: (*AIRCRAFT LANDINGS, ALL WEATHER AVIATION), (*OPTICAL RADAR, *METEOROLOGICAL PHENOMENA), VISIBILITY, CEILING, LANDING FIELDS, MATHEMATICAL ANALYSIS, APPROACH, FLIGHT PATHS (U)
IDENTIFIERS: COMPUTER ANALYSIS, LIDAR(LIGHT DETECTION AND RANGING), LIGHT DETECTION AND RANGING (U)

Lidar (laser radar) data obtained under conditions of low ceiling and visibility are analyzed by hand and by electronic computer to explore the operational utility of lidar in cloud ceiling and visibility determination for aircraft landing operations. Hand analyses of the data show the ability of the lidar to describe the spatial configuration of the low-cloud structure with respect to touch-down point. The problems inherent in evaluation of lidar observations are discussed, and initial approaches to quantitative solutions by computer are presented. It is demonstrated that operationally useful information on the ceiling and visibility conditions contained in the hand analyses can be presented by digitizing the lidar data and subjecting these data to computer analysis. (Author) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOMO7

AD- 674 811 8/3 17/8 14/5
DOUGLAS AIRCRAFT CO INC HUNTINGTON BEACH CALIF ADVANCED RESEARCH LABS

LIDAR INVESTIGATIONS OF THE SPATIAL DISTRIBUTION AND SIZES OF DROPLETS IN SPRAY PLUMES FROM OCEAN WAVES. (U)

DESCRIPTIVE NOTE: Research Communication no. 59,
MAY 68 18P Hall,Freeman F. , Jr.;
Ageno,Harris Y. ;
REPT. NO. DAC-Paper-5015

UNCLASSIFIED REPORT
Availability: Hard copy available from Douglas Advanced Research Labs., 5251 Bolsa Ave., Huntington Beach, Calif. 92646.

DESCRIPTORS: (*OCEAN WAVES, *OPTICAL RADAR), LASERS, PARTICLE SIZE, DIFFUSION, RUBY, SURFACE PROPERTIES, DISTRIBUTION, SAMPLING, WIND, INTERACTIONS, VELOCITY, PHOTOMETERS, SEA BREEZE, UNDERWATER CAMERAS, FEASIBILITY STUDIES, EVAPORATION, ATMOSPHERIC MOTION, STEREOPHOTOGRAPHY (U)
IDENTIFIERS: DROPS, HOLOGRAPHY, LIDAR(LIGHT DETECTION AND RANGING), Q SWITCHING (U)

Use of a pulsed ruby laser to map the three-dimensional development of spray plumes generated by wave action on an isolated rock at Reef Point, near Laguna Beach, California, proved the feasibility of this technique for observing spray diffusion. Observations of plume diffusion under varying conditions of sea breeze and sea state over the 200m path from the reef to the shore showed plume height to be less than would be predicted by turbulent diffusion theory for smoke clouds in thermal equilibrium with the environment. The small vertical development is attributed to the strong thermal inversions which existed over the water when the investigation was conducted, and to settling of the larger spray droplets. Evaporative cooling of the plume may also limit vertical diffusion. The experimental procedure consisted of taking several shots at each laser altitude and azimuth setting to determine the mean plume envelope, and recording holograms of spray near the breaking waves and farther downwind to monitor the evaporation of the droplets. (U)

AD- 657 601 4/1 17/8
NEW YORK UNIV N Y GEOPHYSICAL SCIENCES LAB

OPTICAL SOUNDING III. (U)

DESCRIPTIVE NOTE: Final rept. 1 Apr 66-30 Mar 67,
JUN 67 38P Schotland,R. M. ;Bradley,
James ;Nathan,Alan ;
REPT. NO. 67-2
CONTRACT: DA-28-043-AMC-02207(E)
MONITOR: ECOM 02207-F

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: See also AD-643 562.

DESCRIPTORS: (*OPTICAL RADAR, *ATMOSPHERIC SOUNDING), WATER VAPOR, LASERS, HUMIDITY, RUBY, AEROSOLS, RAYLEIGH SCATTERING, DENSITY, TELLURIC CURRENTS, EQUATIONS, ABSORPTION, PARTICLES, ATMOSPHERIC TEMPERATURE (U)

Studies have been conducted utilizing simulated data of a ruby laser radar to study atmospheric water vapor profiles. Transfer equations have been evaluated incorporating 20 water vapor lines near 6943A. It is shown that the 6943.815A line stands essentially isolated in the telluric spectrum. An analysis is presented of the uncertainties in the deduced water profile obtained for simulated data based upon the 6943.815A line. It is shown that for the present laser radar, the uncertainty in the deduced water vapor density originated primarily in the uncertainty associated with the water vapor absorption coefficient. The Doppler-broadening of radiation scattered from aerosol particles or by Rayleigh scattering processes does not obey the spectral density shape predicted from the Maxwell-Boltzmann distribution of velocities for the particles or air molecules. As Dicke has pointed out, spectral narrowing can occur due to collisions. This phenomenon is discussed in relation to the Doppler spectrum of scattered radiation. The conclusions have been confirmed in experiments reported in the literature. (Author) (U)

AD- 653 725 18/8 20/5 18/9
RAYTHEON CO WALTHAM MASS RESEARCH DIV

RESEARCH STUDY OF A CO2 LASER RADAR TRANSMITTER. (U)

DESCRIPTIVE NOTE: Semiannual technical summary rept., 1
Nov 66-1 May 67,
JUN 67 55P Miles,Perry A. ;Horrigan,
Frank A. ;
REPT. NO. S-970
CONTRACT: N00014-67-C-0264, ARPA Order-306
PROJ: NR-015-714

UNCLASSIFIED REPORT

DESCRIPTORS: (*GAS LASERS, OPTICAL RADAR), (*OPTICAL RADAR, *RADAR TRANSMITTERS), CARBON DIOXIDE, NITROGEN, HELIUM, EXCITATION, OPTICAL PUMPING, AMPLIFIERS, OPTICAL EQUIPMENT, GAS DISCHARGES, ELECTROMAGNETIC PULSES, MOLECULAR ENERGY LEVELS, ELECTRON TRANSITIONS, GAIN (U)

The report concerns the investigation of physical properties of laser amplifiers, using electrically excited mixtures of CO2, N2, and He with a view to producing high-power pulse emission with well-controlled temporal and spatial form. The object of this investigation is to design and build such a source with an average power of 1 kW in a form suitable for use as a laser radar transmitter. Designs have been developed for both dc- and pulse-excited amplifiers and the physical quantities of importance in these designs have been measured. The most notable of these are: the signal intensity required to drive an amplifier to saturation, information on the refractive properties of the discharge, the time constant determining maximum pulse repetition rates, both for the input pulse trace and for the pulse excitation process, and the practical gain levels that can lead to self-oscillation in the amplifier. These measurements lead to the choice of a system in which a train of 10 - 15 microsec pulses at a repetition rate of 10 - 12 kc is amplified by a 50-meter length of dc-excited power amplifier. (Author) (U)

AD- 653 403 17/8
AEROSPACE RESEARCH LABS WRIGHT-PATTERSON AFB OHIO

OPTICAL RADAR AND PASSIVE OPTO-ELECTRONIC RANGING. (U)

FEB 65 13P Gebel,Radames K. H. ;
REPT. NO. ARL-67-0212
PROJ: AF-7885

UNCLASSIFIED REPORT
Availability: Published in The Ohio Journal of Science v66 n5 p496-507 Sep 1966.

DESCRIPTORS: (*OPTICAL RADAR, *OPTICAL EQUIPMENT), RANGE FINDING, ELECTRONIC EQUIPMENT, SIGNAL-TO-NOISE RATIO, IMAGES, RESOLUTION, LIGHT, SENSITIVITY, CIRCUITS, GEOMETRY, DESIGN (U)

The purpose of this paper is to present the fundamental technical arrangement involved for optical radar, its resolution, and requirements concerning the light source for use with it. Some basic optical radar problems are explained and pertinent equations are derived. The paper shows that 10 to the 17th power quanta per pulse at a repetition rate of 77 per second are sufficient to achieve optical radar. If a source can produce the necessary quanta flux with a bandwidth of not more than about 20 A, the job will be as well performed by this source as by a laser. Very promising luminescent semiconductors for such an endeavor, using the visible spectrum, seem to be the II-VI compounds. An automatic passive optical range-finder system using a special pick-up transducer (conceived by the author) which automatically suppresses any background structure (clouds, etc.) is explained. (Author) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOM07

AD- 651 822 17/8
ROCHESTER UNIV N Y INST OF OPTICS

DOPPLER OPTICAL RADAR AND THE HETERODYNE MEASUREMENT OF OSCILLATING SYSTEMS. (U)

DESCRIPTIVE NOTE: Master's thesis,
MAY 67 89P Montonye,James Terrence ;
CONTRACT: TCG-09184A

UNCLASSIFIED REPORT

DESCRIPTORS: (*OPTICAL RADAR, DOPPLER SYSTEMS), LASERS, MEASUREMENT, OSCILLATION, MIXERS(ELECTRONICS), GAS LASERS, DEMODULATION (U)

The measurement of oscillating systems is presented as a prelude to an investigation of Doppler optical radar. The radiation from a single-mode gas laser is used successfully by Doppler optical heterodyne techniques to measure the displacement and velocity waveforms of a moving-coil loudspeaker and a piezoelectric transducer. Vibrations as small as a twentieth of a wavelength (0.000001 cm) and velocities as low as .1 cm per second are measured. A simple method of synchronization is shown to allow convenient measurement of target tilt or distortion as well as the velocity at any point on the target's displacement waveform. Theoretical considerations covering the statistical nature of radiation from thermal light sources are presented and used to demonstrate the feasibility of mixing either independent or correlated thermal light beams. Laser sources are shown to exhibit qualities (specifically narrow bandwidth and high degeneracy values) not characteristic of thermal sources but which are necessary for Doppler optical heterodyning over long target ranges. While offering resolution and directional advantages over conventional microwave radar systems, Doppler optical radar is restricted by target jitter and diffuse target reflectance which increase signal bandwidth and destroy coherence. A study is made of these effects. (Author) (U)

AD- 647 463 4/1 17/8 4/2
STANFORD RESEARCH INST MENLO PARK CALIF

LIDAR-RADAR LOWER ATMOSPHERIC OBSERVATIONS. (U)

DESCRIPTIVE NOTE: Final rept., 1 Apr-11 Nov 66
DEC 66 65P Viezee,William ;Oblanas,John
;
CONTRACT: AF 19(628)-5976
PROJ: AF-5570, SRI-5982
TASK: 667007
MONITOR: AFCRL 67-0013

UNCLASSIFIED REPORT

DESCRIPTORS: (*OPTICAL RADAR, LASERS), (*METEOROLOGICAL PHENOMENA, OPTICAL RADAR), METEOROLOGICAL RADAR, ATMOSPHERIC MOTION, ATMOSPHERES, PROBES (U)
IDENTIFIERS: OPTICAL RADAR (U)

Simultaneous observations of the lower atmosphere with lidar (laser radar) and microwave radar are summarized. The observations are restricted in space to the location of Stanford Research Institute, Menlo Park, California, and in time to June, August, and September 1966. Lidar echoes from the clear lower atmosphere are compared with the temperature and humidity data from the rawinsonde ascents made at Oakland, California. During clear skies, no radar or lidar echoes were observed above 20.00 m. Below this level the atmospheric structure that was analyzed from the lidar data showed a diurnal variation similar to that of the thermal stability of the atmosphere. Other time-dependent variations that were evident in the data are believed to be related to short period changes in the height of the top of the marine layer. No specific relationship was found between the lidar data and the rawinsonde data from Oakland. Radar echoes observed in the clear lower atmosphere were classified as meteorological angles. (Author) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOMO7

AD- 642 447 17/8 20/5 18/5
EG AND G INC BEDFORD MASS

STUDY OF A MULTI-PULSE LASER RANGE FINDER. (U)

OCT 66 62P Ackerman,Sumner ;Morrison, Thomas S. ;
REPT. NO. EG/G-B-3434
CONTRACT: AF 19(628)-5516
PROJ: AF-7600
TASK: 760006
MONITOR: AFCRL 66-755

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: See also AD-642 153.

DESCRIPTORS: (*LASERS, *RANGE FINDING), OPTICAL RADAR, GEODESICS, OPTICAL EQUIPMENT, DETECTION, SATELLITES(ARTIFICIAL) (U)

A programmed multi-pulse optical radar range finder is analyzed. An experimental multi-pulse laser has been developed and its characteristics are described. If the target is optically 'smooth', or is well resolved by the receiver, the multi-pulse range finder has an effective power gain slightly less than its output energy gain when the noise level is low and the detection probability is high. The useful energy gain of a ruby laser due to multi-pulsing was experimentally measured as about 8 dB. Under the conditions of geodetic satellite ranging, the target is generally optically 'rough' in the extreme; then the multi-pulse range finder has a power gain of from 10 dB to over 25 dB, depending on the relative transmitter efficiencies and the acceptable detection probability. This significant increase in the advantage of the multi-pulse system results from the detection statistics that are valid when signal scintillation due to the target is present. (Author) (U)

AD- 642 426 17/8
AIR FORCE CAMBRIDGE RESEARCH LABS L G HANSCOM FIELD MASS

OPTICAL PULSE-RANGING WITH THE NANOLITE. (U)

DESCRIPTIVE NOTE: Instrumentation papers,
SEP 66 10P Fischer,Heinz ;
REPT. NO. AFCRL-IP-116 ,AFCRL-66-653
PROJ: AF-5634
TASK: 563401

UNCLASSIFIED REPORT

DESCRIPTORS: (*OPTICAL RADAR, EFFECTIVENESS), OPTICAL EQUIPMENT, RANGE FINDING, LIGHT PULSES, SPARKS, SOURC(U)

Short-distance ranging of small-size targets by means of a noncoherent Nanolite spark source demonstrates accuracies within a few centimeters at ranges from 10 to 100 m. Several small-size targets can be distinguished within the same scope trace. The source, its operation, and power supply are simple. The device is extremely lightweight. Short-burst repetition rates of approximately 10, 000 pps are possible. (Author) (U)

AD- 640 540 17/8 20/5
HARRY DIAMOND LABS WASHINGTON D C

GALLIUM ARSENIDE LASER RADAR-PRELIMINARY STUDIES. (U)

AUG 66 24P Soper,William L. ;
REPT. NO. TM-66-13,
PROJ: DA-1A010501A015,HDL-36700

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*GALLIUM COMPOUNDS, *ARSENIDES), (*LASERS, *OPTICAL RADAR), MODEL TESTS (U)

The report discusses preliminary work on room-temperature gallium arsenide laser radar and rangefinding. Experimental results are given for three different laboratory models using receivers of up to 20-in. diameter aperture under daylight conditions. (Author) (U)

AD- 636 325 4/1 17/9 17/8
HONEYWELL INC ST PAUL MINN RESEARCH DEPT

STUDY OF TECHNIQUES FOR DETECTION AND MEASUREMENT OF CLEAR AIR TURBULENCE. (U)

DESCRIPTIVE NOTE: Final rept., 15 Nov 62-30 Oct 65.
JAN 66 135P Zirkle,Raymond E. , Jr;
REPT. NO. 1540-FRI,
CONTRACT: AF 19(628)-2376,
PROJ: AF-6670,
TASK: 667007,
MONITOR: AFCRL 66-115

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*CLEAR AIR TURBULENCE, RADAR TRACKING), (*OPTICAL RADAR, *METEOOROLOGICAL RADAR), ATMOSPHERIC MOTION, OPTICAL TRACKING, LASERS, BACKSCATTERING, DOPPLER EFFECT, CORRELATION TECHNIQUES (U)

Two general ways in which laser optical radar (optar) might be useful for clear air turbulence detection were examined. The first method involves spectral analysis of doppler-shifted light, backscattered by moving particles, to provide measures of average and gust spectrum velocity components. The second method involves the mapping of particle formations arrayed in the atmosphere by correlates of rough flying conditions such as wind shear, the jet stream, mountain waves, etc. Calculations show that the particulate matter of the troposphere which dominates optical backscatter is dynamically suitable for the mapping of wind motions consistent with anticipated requirements of CAT detection. Experiments by other groups have shown that laser doppler methods can measure particle velocities in the laboratory. Experimental extensions of these techniques will be needed to apply the concept to aircraft. An experimental program with pulsed ruby laser optars was conducted. Particle arrays were detected in both laboratory and field environments, but no evidence was obtained indicating a correlation with turbulent conditions. Laboratory turbulence-generated refractive index changes were much higher than those encountered in the atmosphere. Field tests at Rollinsville, Colorado were inconclusive due to poor weather conditions. (U)

AD- 635 030 17/9 4/2 1/2
MICHIGAN UNIV ANN ARBOR

AIRBORNE INVESTIGATIONS OF CLEAR AIR TURBULENCE WITH OPTICAL RADAR. (U)

DESCRIPTIVE NOTE: PROGRESS REPT.,
DEC 65 175P Franken, P. A. ;Jenney,J. A. ; Rank,D. M. ;
CONTRACT: Nonr-1224(51),

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*CLEAR AIR TURBULENCE, RADAR SCANNING), (*OPTICAL RADAR, *METEOROLOGICAL RADAR), (*ALL WEATHER AVIATION, CLEAR AIR TURBULENCE AIRBORNE), FLIGHT INSTRUMENTS, LASERS, RADAR EQUIPMENT, RADAR CROSS SECTIONS, AEROSOLS, ATMOSPHERIC MOTION, FLIGHT TESTING, AVIATION SAFETY (U)

The program was initiated to explore the possibility that characteristic optical radar echoes might actually be correlated with clear air turbulence. A light twin engine airplane was equipped with a laser radar and ancillary equipment for monitoring acceleration, temperature variations, and relevant meteorlogical data. The design of this equipment and the development of the flight programs was predicated on theoretical considerations of optical scattering from particulate matter. (Author) (U)

AD- 634 006 4/2 17/9 4/1
RESEARCH LAB OF ELECTRONICS MASS INST OF TECH
CAMBRIDGE

OBSERVATIONS OF THE UPPER ATMOSPHERE BY OPTICAL RADAR
IN ALASKA AND SWEDEN DURING THE SUMMER 1964. (U)

JUN 65 6P Fiocco,G. ;Grams,G. ;
CONTRACT: DA-36-039-AMC-03200(E),

UNCLASSIFIED REPORT
Availability: Published in Tellus v18 n1 p34-8 1966.

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*OPTICAL RADAR, *ATMOSPHERIC SOUNDING), (*UPPER ATMOSPHERE, RADAR SCANNING), (*METEOROLOGICAL RADAR, OPTICAL RADAR), METEOROLOGICAL PHENOMENA, ALASKA, SWEDEN (U)

Reprint: Observations of the upper atmosphere by optical radar in Alaska and Sweden during the summer 1964.

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOMO7

AD- 623 513
NEW YORK UNIV N Y GEOPHYSICAL SCIENCES LAB

STUDY OF ACTIVE PROBING OF WATER VAPOR PROFILES AND RESULTS OF EXPERIMENTS. (U)

DESCRIPTIVE NOTE: Final rept. pt. 1 on Optical Sounding II for 6 Nov 63-15 Jul 65.
JUL 65 95P Schotland,R. M. ;Chang,D. ; Bradley,J. ;
REPT. NO. 65-6
CONTRACT: DA36 039AMC03411E
PROJ: 1VO 14501B53A02 03

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*LASERS, ATMOSPHERIC SOUNDING), (*ATMOSPHERIC SOUNDING, LASERS), (*WATER VAPOR, ATMOSPHERES), RUBY, OPTICAL INSTRUMENTS, RADAR, LIGHT TRANSMISSION, REFLECTION, AEROSOLS, SPECTROSCOPY (U)

A ruby laser system has been assembled which includes provision for thermally tuning the laser operating wavelength. Experiments have been carried out which were designed to test the potential of such a radar for the remote determination of the vertical profile of water vapor by means of a spectral study of the back scattered energy. The results of the experiments indicate that such measurements are feasible. However, detailed information must be obtained on the water vapor absorption line structure. A theoretical study has been undertaken of the contribution of secondary molecular scattering to the return observed by a laser optical radar. The results are presented as a function of the beam width of the receiver optics and the wavelength of the laser. It is shown that the contribution of secondary scatter to the observed energy can be made negligibly small by suitably restricting the beam width of the receiver optics. (Author) (U)

AD- 621 630
ELECTRO-OPTICAL SYSTEMS INC PASADENA CALIF

OPTICAL TRANSMITTER TECHNIQUES. (U)

DESCRIPTIVE NOTE: Interim rept. for 15 Jul-15 Oct 64,
SEP 65 20P
REPT. NO. 5180-Q-2
CONTRACT: AF30 602 3440
PROJ: 4506
TASK: 450608
MONITOR: RADC , TR-64-526

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*LASERS, MATERIALS), (*OSCILLATORS, LASERS), RARE EARTH COMPOUNDS, COMPLEX COMPOUNDS, FLUORESCENCE, SENSITIVITY, DIFFUSION, HEAT EXCHANGERS, EXCITATION, RADAR TRANSMITTERS, OPTICAL INSTRUMENTS, GASES (U)
IDENTIFIERS: CHELATING AGENTS (U)

Work is described directed toward the design and fabrication of a gas laser oscillator and a solid-state chelate laser operating at wavelengths ranging from 5.0 to 0.3 microns. During the reporting period, the optimized material using sensitized fluorescence was tested for laser action. Under the high energy intensities of flashes, photo-reaction products are detected. This problem has been solved using new sensitizers and/or new solvents. But the quantum field is somewhat low with these sensitizers. Work is in progress to improve the quantum field. The mechanisms of the energy transfer in chelates have been further clarified and it is shown that the optical pumping scheme in the rare-earth chelate to achieve population inversion does not involve any inefficient process. (Author) (U)

AD- 610 737
CONTROL DATA CORP MELVILLE N Y TRG DIV

DOPPLER OPTICAL NAVIGATOR. (U)

DESCRIPTIVE NOTE: Interim engineering rept. no. 2, 1 Sep-30 Nov 64,
NOV 64 36P Pogoda,A. L. ;LaTourrette,J. T. ;Jarrett,S. ;Jacobs,S. ;reich,S. ;
REPT. NO. TRG-019-I-2
CONTRACT: AF33 615 1973
PROJ: 4427
TASK: 442701

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*DOPPLER NAVIGATION SYSTEMS, LASERS), (*LASERS, DOPPLER NAVIGATION), DOPPLER SYSTEMS, DESIGN, OPTICAL EQUIPMENT, DOPPLER RADAR, FEASIBILITY STUDIES, SIGNAL-TO-NOISE RATIO, MICROWAVES, DEMODULATION, ATMOSPHERES, XENON, HELIUM, ELECTRONICS (U)

The objective of this program is to determine the feasibility of techniques leading to a Doppler optical navigator for measuring instantaneous ground speed with 0.1 ft/sec accuracy for altitudes of 250 to 5000 feet. Present microwave Doppler radars are limited in short term accuracy due to the large relative bandwidth of the Doppler return signal which is caused by the large beamwidth (2 degrees). A Doppler optical sensor using a laser transmitter will generate a narrow beam (0.1 milliradian or less) which results in a Doppler return of narrow bandwidth. The approach chosen utilizes a CW laser as a transmitter and detects the Doppler shift in the carrier frequency using optical heterodyning techniques. The program includes laboratory experimentation, literature search and design analysis which shall result in a feasibility breadboard of an Optical Doppler Radar. (Author) (U)

AD- 610 734
CONTROL DATA CORP MELVILLE N Y TRG DIV

DOPPLER OPTICAL NAVIGATOR. (U)

DESCRIPTIVE NOTE: Interim engineering rept. no. 1, 1 Jun-31 Aug 64,
AUG 64 36P Pogoda,A. L. ;LaTourrette,J. T. ;Jarrett,S. ;jacobs,S. ;
REPT. NO. TRG-019-I-1
CONTRACT: AF33 615 1973
PROJ: 4427
TASK: 442701

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*DOPPLER NAVIGATION SYSTEMS, LASERS), (*LASERS, DOPPLER NAVIGATION), DOPPLER SYSTEMS, DESIGN, OPTICAL EQUIPMENT, DOPPLER RADAR, FEASIBILITY STUDIES, SIGNAL-TO-NOISE RATIO, MICROWAVES, DEMODULATION, ATMOSPHERES, ADSORPTION, THEORY (U)

The objective of this program is to determine the feasibility of techniques leading to a Doppler optical navigator for measuring instantaneous ground speed with 0.1 ft/sec accuracy for altitudes of 250 to 5000 feet. Present microwave Doppler radars are limited in short term accuracy due to the large relative bandwidth of the Doppler return signal which is caused by the large beamwidth (2 degrees). A Doppler optical sensor using a laser transmitter will generate a narrow beam (0.1 milliradian or less) which results in a Doppler return of narrow bandwidth. The approach chosen utilizes a CW laser as a transmitter and detects the Doppler shift in the carrier frequency using optical heterodyning techniques. The program includes laboratory experimentation, literature search and design analysis which shall result in a feasibility breadboard of an Optical Doppler Radar. (Author) (U)

AD- 610 466
SPERRY GYROSCOPE CO GREAT NECK N Y

COHERENT OPTICAL ARRAY TECHNIQUES. (U)

DESCRIPTIVE NOTE: Interim technical documentary rept. no. 2, 1 Jun-31 Aug 64.
JAN 65 60P
REPT. NO. AB-1272-0016-2
CONTRACT: AF30 602 3329
PROJ: 4506
TASK: 450608
MONITOR: RADC , TDR64 462

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: See also AD-608 220.

DESCRIPTORS: (*RADAR, LASERS), (*COHERENT RADAR, LASERS), (*PHASED ARRAYS, COHERENT RADAR), (*LASERS, COHERENT RADAR), OPTICAL EQUIPMENT, CONTINUOUS WAVE RADAR, PHASE SHIFT CIRCUITS, SOLID STATE PHYSICS, OSCILLATORS, AMPLIFIERS, BEAMS (ELECTROMAGNETIC), PUMPING (ELECTRONICS), CRYSTALS, NEODYMIUM, CALCIUM COMPOUNDS, TUNGSTATES (U)

Studies are being conducted to determine the feasibility of a coherent optical phased array system. When fully developed, such a system would not only provide increased beam power concentration on distant targets, but could also result in electronic beam steering. The over-all plan is to demonstrate feasibility by developing a subassembly consisting of a cw laser master oscillator driving two pulsed laser power amplifiers in parallel. The required phase shifters and power dividers would be incorporated to demonstrate the principles of a coherent optical phased array. The investigation is being conducted for an operating wavelength of 1.06 microns. Solid state and gas lasers were considered for the master oscillator. No satisfactory 1.06micron transition has been found for a gas laser system. Consequently, all effort is being concentrated on solid state devices. A Nd:CaWO4 laser has produced a multimode CW output of 160 milliwatts. Single-mode work is being pursued. (U)

AD- 610 106
ELECTRO-OPTICAL SYSTEMS INC PASADENA CALIF

OPTICAL TRANSMITTER TECHNIQUES. (U)

DESCRIPTIVE NOTE: Quarterly progress rept. no. 1, 15 Apr-15 Jul 64,
DEC 64 58P Bhaumik,M. L. ;Nugent,L. J. ;
REPT. NO. EOS-5180-Q-1
CONTRACT: AF30 602 3440
PROJ: 4506
TASK: 450608
MONITOR: RADC , TDR64 442

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*LASERS, MATERIALS), (*OSCILLATORS, LASERS), RARE EARTH COMPOUNDS, COMPLEX COMPOUNDS, FLUORESCENCE, SENSITIVITY, DIFFUSION, TEST EQUIPMENT, PHOTONS, HEAT EXCHANGERS, AROMATIC COMPOUNDS, ATOMIC ENERGY LEVELS, RADAR TRANSMITTERS, OPTICAL INSTRUMENTS (U)

The report describes work directed toward the design and fabrication of a gas laser oscillator and a solidstate chelate laser operating at wavelengths ranging from 5.0 to 0.3 microns. New classes of sensitized fluorescence and their sensitizers were investigated and system efficiency was improved through sensitizer purification. Some of the new sensitized systems investigated show promise of operation at or above room temperature. The scientific basis for sensitized fluorescence is clarified through a detailed analysis and description of the mechanism of energy transfer. Appropriate laser calculations and optimization were accomplished and associated laser test cavities, heat exchangers, and other equipment were built in preparation for testing the new materials. (Author) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOMO7

AD- 604 689
PERKIN-ELMER CORP NORWALK CONN

STUDY AND EXPERIMENTAL PROGRAM OPDAR TRAJECTORY MEASUREMENT SYSTEM. (U)

DESCRIPTIVE NOTE: Final rept.,
JUL 64 513P Krauss,B. ;McNeill,J. ;
McFarlane,R. ;Freeman,H. R. ;Rowley,R. ;
REPT. NO. PE-7534B
CONTRACT: AF30 602 3189
PROJ: 5930
TASK: 593006
MONITOR: RADC , TDR64 169

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*GUIDED MISSILE TRACKING SYSTEMS, LASERS), (*LASERS, GUIDED MISSILE TRACKING SYSTEMS), GUIDED MISSILE TRAJECTORIES, MEASUREMENT, OPTICAL EQUIPMENT, RADAR TRACKING, MODELS (SIMULATIONS), FEASIBILITY STUDIES (U)

A CW optical radar (OPDAR) for precise early launch phase trajectory measurement is described. A single instrument measures slant range, azimuth and elevation to a small, passive retroreflector mounted on the missile. The data collected is suitable for real-time trajectory evaluation and for post flight computer processing to yield highly precise position, velocity, and acceleration information. Laboratory models of critical components were constructed to demonstrate system feasibility. Models included a shaft angle encoder, a retroreflector, and a model of the range measurement system. An experiment was conducted to measure the effects of laser noise. (Author) (U)

AD- 465 151
LOCKHEED ELECTRONICS CO PLAINFIELD N J

PULSE COMPRESSION OPTICAL RANGING STUDIES. (U)

DESCRIPTIVE NOTE: Quarterly progress rept. no. 3, 15 Dec 6414 Mar 65,
MAR 65 42P Reich,A. ;Tarasevich,A. ;
Barrett,C. W. ;
CONTRACT: DA28 043AMC00172E
PROJ: 1P6 20901A199
TASK: 1P6 20901A199 02

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*RANGE FINDING, OPTICAL EQUIPMENT), (*RANGE FINDING, PULSE COMPRESSION), LASERS, ATMOSPHERES, ATTENUATION, ULTRASONIC RADIATION, TRANSDUCERS, CADMIUM COMPOUNDS, SULFIDES, QUARTZ, DATA PROCESSING, LIGHT PULSES, SIGNAL-TO-NOISE RATIO, CODING, WATER VAPOR, CARBON DIOXIDE, LIGHT TRANSMISSION, DEMODULATORS, PHOTOELECTRIC CELLS(SEMICONDUCTOR), POWER AMPLIFIERS, MATCHED FILTERS (U)
IDENTIFIERS: PULSE EXPANSION (U)

Progress on the optical/ultrasonic pulse compressor experimental breadboard is discussed. The major part of this period's effort has been devoted to optical correlation and pulse expansion. The highlights of this reporting period are: Improved diffusion layer transducers have been fabricated. Pulse encoding and expansion with a CdS-quartz ULM at 120 Mc has been obtained. Progress has been made on the pulse expansion-compression loop. The difference between pulse integration and the integration of the correlation process is explained in the system analysis. A practical comparison between a pulsed laser radar and a continuous wave (cw) laser radar is shown. A digest of the signal-tonoise advantage of pulse compression is given. A report on the effects of atmospheric attenuation is also included. (Author) (U)

AD- 434 586
AIR FORCE CAMBRIDGE RESEARCH LABS L G HANSCOM FIELD MASS

FEASIBILITY OF A LUNAR OPTICAL RANGING EXPERIMENT, (U)

DEC 63 24P Iliff,Robert L. ;Tavenner, Michael S. ;
PROJ: 7600
MONITOR: AFCRL 63 908

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*LASERS, RANGE FINDING), (*RANGE FINDING, LASERS), MOON, PHOTOMULTIPLIER TUBES, BACKGROUND, SCATTERING, PHOTONS, NIGHT SKY, RESOLUTION (U)

A lunar ranging experiment using a high energy pulsed laser is discussed giving special attention to the required minimum return signal, interfering radiation, detector devices, and pulse length. (Author) (U)

AD- 434 227
RADIO CORP OF AMERICA CAMDEN N J DEFENSE ELECTRONIC PRODUCTS

DOPPLER OPTICAL NAVIGATOR. (U)

DESCRIPTIVE NOTE: Quarterly prgram rept. no. 3, 6 Dec 636 Mar 64,
MAR 64 59P Hannan,W. J. ;Nicastro,L. J. ;Penn,T. E. ;Vollmer,J. ;
CONTRACT: AF33 657 11458

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*DOPPLER NAVIGATION, LASERS), (*NAIGATIONAL AIDS, SPACEBORN), DOPPLER EFFECT, GUIDANCE, SATELLITES (ARTIFICIAL), AEROSPACECRAFT, ATMOSPHERES, ATTENUATION, GALLIUM COMPOUNDS, ARSENIDES, SCATTERING, VELOCITY, SIMULATION (U)

The objective of this program is to determine the feasibility of novel laser techniques for Doppler optical navigation. The performance goal is the measurement of ground speed of a satellite, travelin. at a velocity of 10,000 meters per second at an altitude of 300 miles, with an accuracy of 5 meters per second. Doppler measurements, using a laboratory Dpol r simulatr, verified that more tha one complete cycle of Doppler shift must be .eejated by discrete jeflecting elements for Doppler freu ncy to be measured accujately. OKPERATION OF A THERMELECTRICALLY COOLED GALLIUM-AJSENIDE LASER TRANSMITT R WAS DEMONSTRATED. This refjigeration t c:nique mak s injection lasers pjactical. (Author) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. ZOMO7

AD- 430 129
AEROSPACE CORP EL SEGUNDO CALIF

INVESTIGATION OF GAS LASERS AND NONLINEAR OPTICAL EFFECTS. (U)

DESCRIPTIVE NOTE: Semiannual technical note, 1 Jan-30 June 63,
DEC 63 45P Hartwick,T. S. ;Peressini,E. R. ;Ward,R. C. ;Buczek,C. J. ;
REPT. NO. TDR169 3250 21TN2
CONTRACT: AF04 695 169
MONITOR: SSD TDR63 351

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: Report on Electronics Research Program.

DESCRIPTORS: (*LASERS, GASES), (*FREQUENCY MODULATION, MAGNETIC FIELDS), GAS DISCHARGES, HELIUM, NEON, DIRECT CURRENT, ELECTRODES, OPTICAL PROPERTIES, RADAR (U)

An analysis is given of frequency modulation of a gas laser by a time-varying axial magnetic field. Preliminary experimental results are reported. A helium-neon laser employing a dc-excited discharge between close-spaced parallel electrodes has yielded laser action at a wavelength of 1.15 microns. Analysis and experimental results show that the 'gain-switching' technique will be very useful for the repeated, reliable production of short, high-power laser pulses needed in the study of nonlinear optical effects and in optical radar. (Author) (U)

CORPORATE AUTHOR - MONITORING AGENCY

*AEROSPACE CORP EL SEGUNDO CALIF
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TDR169 3250 21TN2
INVESTIGATION OF GAS LASERS AND NONLINEAR OPTICAL EFFECTS.
(SSD-TDR63 351)
AD- 430 129

*AEROSPACE RESEARCH LABS WRIGHT-PATTERSON AFB OHIO
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ARL-67-0212
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AD- 653 403

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*AIL MELVILLE N Y
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AFCRL-66-115
STUDY OF TECHNIQUES FOR DETECTION AND MEASUREMENT OF CLEAR AIR TURBULENCE.
AD- 636 325
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AFCRL-66-755
STUDY OF A MULTI-PULSE LASER RANGE FINDER.
AD- 642 447
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AD- 678 103
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AD- 700 094
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AFCRL-70-0598
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AD- 716 483
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AFCRL-72-0154
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AD- 742 359
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AFCRL-72-0167
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AD- 741 875
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AD- 434 586

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*AIR FORCE GEOPHYSICS LAB HANSCOM AFB MASS

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*AMERICAN OPTICAL CORP SOUTHBRIDGE MASS

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AO-623-F
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(AFGL-TR-76-0177)
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*ARMY ELECTRONICS COMMAND FORT MONMOUTH N J

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*ARMY ENVIRONMENTAL HYGIENE AGENCY ABERDEEN PROVING GROUND MD

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*ARMY MISSILE COMMAND REDSTONE ARSENAL ALA ADVANCED SENSORS LAB
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*ARMY MISSILE COMMAND REDSTONE ARSENAL ALA PHYSICAL SCIENCES LAB
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*ARMY MISSILE COMMAND REDSTONE ARSENAL ALA PHYSICAL SCIENCES DIRECTORATE
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AD- 785 697

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AD-A042 349

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*ARMY RESEARCH OFFICE RESEARCH TRIANGLE PARK N C
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AD-A022 471
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ARO-11758.4-EL
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AD-A001 235
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ARO-12120.9P
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AROD-7027:9-P
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AROD-7027:12-P
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AROD-7027:13-P
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AD- 732 811
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*ATOMIC ENERGY COMMISSION WASHINGTON D C
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PNE-1108
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AD- 735 656

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PNE-1110
Project Pre-Gondola I: Lidar Observations of the Pre-Gondola I Clouds.
AD- 735 659

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PNE-1119
Project Pre-Gondola II. Airborne Lidar Observations.
AD- 735 657

*AUTONETICS ANAHEIM CALIF

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C7-1613.5/501
COHERENT OPTICAL ADAPTIVE TECHNIQUES.
(RADC-TR-68-190)
AD- 837 611

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C9-1641/501
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AD- 693 189

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(RADC-TR-70-48)
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*AVCO EVERETT RESEARCH LAB EVERETT MASS

* * *

Secede Laser Radar Experiment.
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*AVCO EVERETT RESEARCH LAB INC EVERETT MASS

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